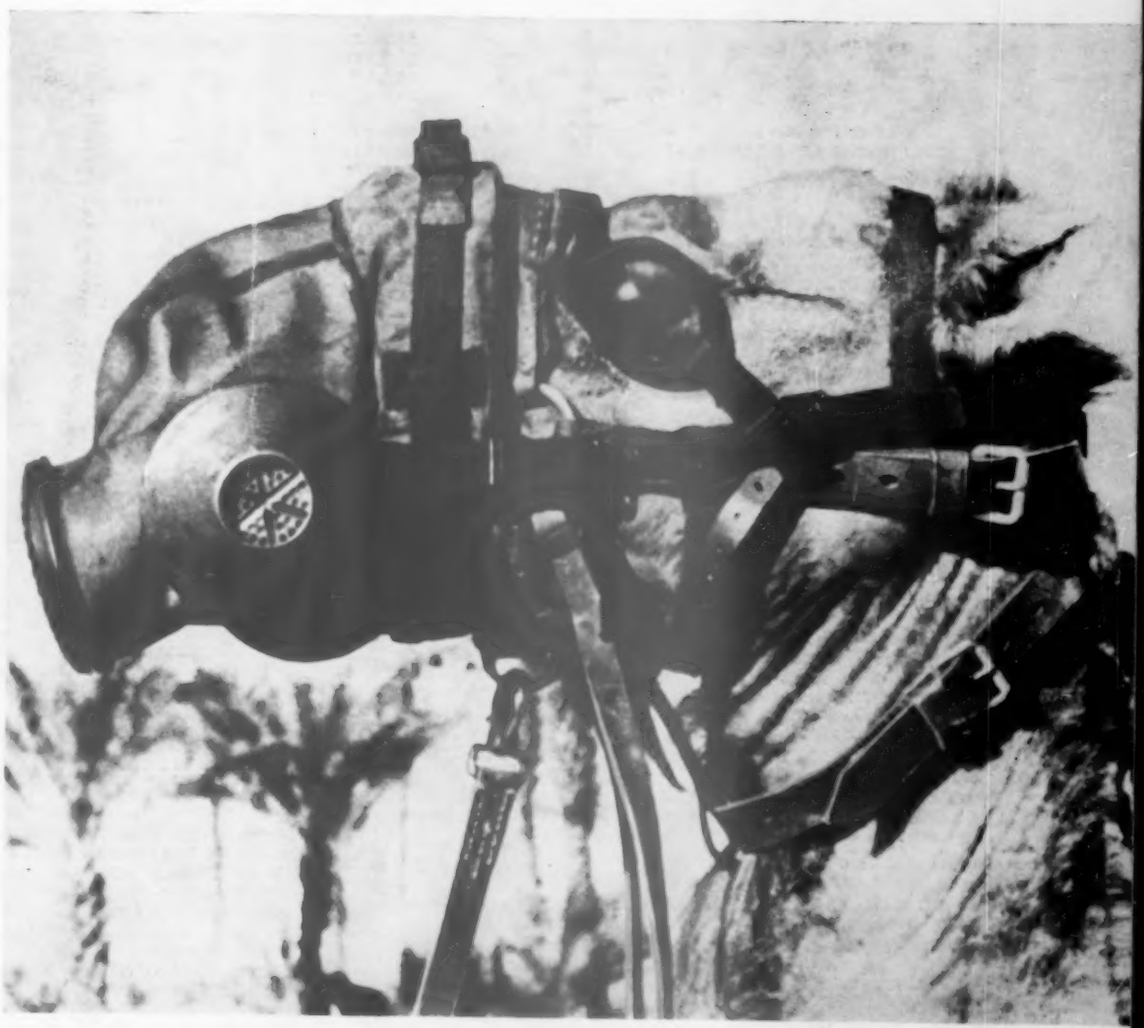
UG
447
.A2
A73

THE UNIVERSITY OF MICHIGAN
JUN 29 1959
CHEMISTRY LIBRARY

ARMED FORCES CHEMICAL JOURNAL



MARCH-APRIL 1959

ARMED FORCES CHEMICAL ASSOCIATION

National Headquarters

408-410 Park Lane Building—2025 Eye Street, N.W.

WASHINGTON 6, D.C.

(Republic 7-6803)

The members of this Association, mindful of the vital importance to national defense of chemistry, allied sciences, and the arts derived from them, have joined together as a patriotic obligation to preserve the knowledge of, and interest in, national defense problems derived from wartime experience; to extend the knowledge of, and interest in, these problems; and to promote cooperative endeavor among its members, the Armed Services, and civilian organizations in applying science to the problems confronting the military services and other defense agencies, particularly, but not exclusively in fields related to chemical warfare. (From Art. II, AFCA Constitution.)

Honorary President
MAJ. GEN. MARSHALL STUBBS
Chief Chemical Officer
Department of the Army
Washington, D.C.

NATIONAL OFFICERS

President
BRIG. GEN. CLIFFORD L. SAYRE
USAR
New York, N.Y.

Vice President
COL. ROBERT T. NORMAN
(Chairman of Finance Committee)
Washington, D.C.

Vice President
MR. HARRY A. WANSKER
(Chairman of Membership and Organization Committee)
Cambridge, Mass.

Vice President
MR. DONALD MacARTHUR
(Chairman of Meetings Committee
Washington, D.C.

Immediate Past President
MR. GLENN A. HUTT
Cleveland, Ohio

Senior Vice President
MAJ. GEN. C. E. LOUCKS, USA (Ret.)
Washington, D.C.

Vice President
DR. HAROLD C. WEBER
(Chairman of Research and Development Committee)
Milton, Mass.

Secretary-Treasurer
LT. COL. OVID E. ROBERTS, JR.
USAR (Ret.)
Silver Spring, Md.

Vice President
DR. WALTER J. MURPHY
(Chairman of Publications Committee)
Washington, D.C.

Vice President
LT. COL. WALTER E. SPICER, JR.
(Chairman of War Mobilization Planning Committee)
Lititz, Pa.

General Counsel
MR. CHARLES E. PLEDGER, JR.
Washington, D.C.

Chapter Presidents and Secretaries

CHESAPEAKE CHAPTER—Mr. S. Yeardley Smith, *Pres.*; Mr. Charles J. Helmer, *Sec.*, Chemical Corps Engineering Command, (Bldg. 250) Army Chemical Center, Md.; Mr. Raymond S. Bailleul, *Treas.*, Chemical Corps Materiel Command, Army Chemical Center, Md.

CINCINNATI—Mr. F. L. Diehl, *Pres.*; Mr. W. Pilcher, *Sec.-Treas.*, 2626 Victory Parkway, Cincinnati 6, Ohio.

CLEVELAND—Mr. C. H. Alexander, *Pres.*; Mr. Leslie F. Howell, *Sec.-Treas.*, Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio.

DALLAS—Mr. King George Irving, *Pres.*; Mr. Jack C. Jones, *Sec.-Treas.*, Room 1021, 1114 Commerce St., Dallas, Tex.

FORT DETRICK—Col. Joseph C. Prentice, *Pres.*; Mr. James A. Kime, *Treas.*, 603 Biggs Ave., Frederick, Md.

FORT McCLELLAN—Col. C. V. Burke, *Pres.*; Capt. F. D. Gravois, Jr. *Sec.-Treas.*, Chemical Corps School, Ft. McClellan, Ala.

GEORGIA INSTITUTE OF TECHNOLOGY STUDENT CHAPTER—Mr. Andy Clark, *Pres.*; Mr. John Sajem, *Sec.-Treas.*, Box 251, Georgia Tech., Atlanta 13, Ga.

MEMPHIS—Mr. Paul J. Traut, *Acting Pres.*, 192 Dille Place, Memphis, Tenn.

MIDWEST—Mr. Gaillard Rumford, *Pres.*; Mr. James J. Doheny, *Sec.-Treas.*, 86 E. Randolph St., Chicago, Ill.

NEW ENGLAND—Mr. Harry A. Wansker, *Pres.*; Mr. John H. Adams. *Sec.*, 30 Memorial Drive, Cambridge, Mass.; Mr. Chenery Salmon, *Treas.*, Coffin & Burr, Inc., 60 State St., Boston 9, Mass.

NEW YORK—Mr. James Sheridan, *Pres.*; Mr. Joel Henry, *Sec.-Treas.*, American Inst. of Cml. Engineers, 25 West 45th St., New York, N.Y.

PINE BLUFF ARSENAL—Mr. Conrad J. B. Hardy, *Pres.*; Mr. Edward Woodford, *Sec.-Treas.*, 2200 S. Harrison St., Little Rock, Ark.

PITTSBURGH—Mr. Fred C. Hickey, *Pres.*; Dr. Charles A. Kiernan, *Sec.-Treas.*, 1524 Pennock Road, Pittsburgh, Pa.

ROCKY MOUNTAIN ARSENAL—Mr. Louis R. Degen, *Pres.*, 1050 South Broadway, Denver, Colo.

SAN FRANCISCO—Mr. Christian J. Matthew, *Pres.*; Mr. John Nimz, *Sec.-Treas.*, Union Carbide Chemicals Co., 22 Battery St., San Francisco 6, Calif.

SOUTHERN CALIFORNIA—Col. Samuel P. Pickett, *Pres.*; Maj. Thomas J. McEniry, *Sec.-Treas.*, 131 N. Garfield Ave., Alhambra, Calif.

WASHINGTON, D. C.—Mr. L. Douglas Weiford, *Pres.*; Mr. Carroll W. Hayes, *Sec.-Treas.*, Celanese Corp. of America, 1026 17th St., N.W., Washington, D.C.

WILMINGTON—Mr. Henry T. Clark, *Pres.*; Dr. William J. Taylor, Jr., *Sec.-Treas.*, Atlas Powder Co., Wilmington, Del.

Chemistry
Gift
Direct
6-11-59

Armed Forces CHEMICAL JOURNAL

OFFICIAL PUBLICATION OF THE ARMED FORCES CHEMICAL ASSOCIATION
SUITES 408-410, 2025 EYE STREET, N.W., WASHINGTON 6, D.C.

VOLUME XIII | MARCH-APRIL | NUMBER 2

POLICY

The fact that an article appears in this magazine does not indicate approval of the views expressed in it by any one other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors. It is the responsibility of contributors, including advertisers, to obtain security clearance, as appropriate, of matter submitted for publication. Such clearance does not necessarily indicate indorsement of the material for factual accuracy or opinion by the clearing agency.

Editor
COL. JOHN C. MacARTHUR
U.S.A.-(Ret.)

Contributing Editors
DR. DAVID B. DILL; MR. JOHN A. KLEY; MR. IRVING PORETZ

Advertising Director
LT. COL. O. E. ROBERTS, JR.
USAR-(Ret.)

FRONT COVER

Yes, it's true—it's a gas mask for and on a camel—in World War II! See Story on page 13.

PHOTO CREDITS

All U.S. Army photos except page 14 (unknown); Page 18 (unknown); Page 34, left column (unknown); and cover.

INDEX

	Page
A.F.C.A. Affairs	2
Armed Forces Day—1959 Program	4
Camel Mask Featured in Museum Display	13
Chemical Corps News	34
Chemist in the International Geophysical Year ..... Hugh Odishaw	30
Chemistry at Work for the U.S. Army... *By* Major E. M. Gershater, CmlC	14
Defense Chemistry ..... *By* Dr. William T. Read, Sr.	20
Historical Corner, The ..... *By* Brooks E. Kleber	40
Improving Our Capabilities for Limited War ..... *By* General Maxwell D. Taylor	6
Our Army in Europe	10
R.O.T.C.—Follow-up of Award Winners	18
Dr. Herbert F. York Appointed Director of Defense Research and Engineering	4

ADVERTISERS

	Page		Page
Acme Protection Equipment Company	13	General Tire & Rubber Company, Industrial Products Division	17
Columbia-Southern Chemical Corp.	iv	Harshaw Chemical Co., The	25
Delta Chemical Works, Inc.	12	Kuhn, H. A., Consultant	21
Diamond Alkali Company	9	Reynolds Metals Company	29
Dow Chemical Company, The	5	Shell Chemical Corporation	23
Fisher Scientific Company	37	Stauffer Chemical Company	19
		Witco Chemical Company	3

Published bi-monthly—Jan.-Feb.; Mar.-Apr.; May-June; July-Aug.; Sept.-Oct.; Nov.-Dec.—by the Armed Forces Chemical Association, National Headquarters, located at Suite 408, 2025 Eye St., N.W., Washington 6, D.C. Entered as second class matter at the Post Office at Washington, D.C., under the Act of March 3, 1879. Additional entry at Nashville, Tenn. Subscription price $3.00 per year to members; $6.00 per year to non-members in the United States, Canada and Mexico; elsewhere $1.00 additional for postage. Inquiries concerning circulation and advertising should be addressed to the Secretary-Treasurer.

AFCA AFFAIRS

PRESIDENT SAYRE ADDRESSES WASHINGTON CML.C. RESERVES

WASHINGTON, D. C.—Reserve officers of the Washington, D.C., area were given an outline of the future plans of the Armed Forces Chemical Association by its president, Brigadier General Clifford Sayre (USAR), when he was the guest speaker at a January 19 dinner-meeting of Mobilization Detachment No. 30. The detachment is composed of reserve officers holding mobilization designations to the Office of the Chief Chemical Officer.

The affair, held at the Bolling Air Force Base officers' mess, afforded many of the reserve officers a chance to renew acquaintances with Major General Marshall Stubbs for the first time since he became Chief Chemical Officer. General Stubbs was the guest of honor for the occasion.

General Sayre's talk included a brief history of the A.F.C.A.; some of its current activities, including the expanding ROTC awards program, and the part reserve officers are playing in them; the need for an enlarged association membership; and some of the plans for this year's annual meeting of the association which will be held in Washington during September. General Sayre, who is Director of Central Engineering for the Chemical Divisions of the Food Machinery and Chemicals Corporation, was on 15-days active duty in the Office of the Chief Chemical Officer at the time of the meeting.

Also speaking briefly during the meeting were Colonel Robert T. Norman, vice president of A.F.C.A., who recently retired from the reserves after serving as the detachment's commanding officer; and Major G. S. Norman, Senior Unit Advisor, District of Columbia Military District.

AFCA ACTIVITIES ARE DISPLAYED

Major General Marshall Stubbs, Chief Chemical Officer of the Army, and Honorary President of A.F.C.A., looks over a bulletin board display pertaining to the Association's activities and interests. The display was arranged by some Washington area friends of the Association to stimulate interest among prospective members.

NEW ENGLAND CHAPTER AWARDS PLAQUE TO VERMONT TEACHER

New England Chapter's selection as their candidate for A.F.C.A.'s $1000 Science Teacher award in 1958 was Mrs. Faith Sholes, instructor in biology and general science at Middleburg (Vermont) Union High School.

As the Chapter's selection as outstanding high school science teacher of the region, and as a runner-up in the nationwide selection by A.F.C.A., Mrs. Sholes was named for an A.F.C.A. bronze plaque and also for a cash award from New England Chapter.

Presentation of these awards to Mrs. Sholes was made at ceremonies held at the school last December by Mr. Chenery Salmon, Treasurer of New England Chapter. School officials, faculty members and students participated in extending congratulations to Mrs. Sholes.

Both the Superintendent and Principal expressed their appreciation to Mr. Salmon for making the trip to Middleburg to extend the Chapter honors to Mrs. Sholes.

WILMINGTON CHAPTER TO HEAR GENERAL STUBBS

Major General Marshall Stubbs, Chief Chemical Officer of the Army, is scheduled as the speaker for the dinner meeting of Wilmington Chapter, at Hunter Restaurant in the Delaware Trust Building, Wilmington, Delaware, at 6:30 PM, March 31.

"DISCOMBOBULATORS"

The word **discomboberate** and variations including **discombobulate**, meaning to preplex, puzzle or confuse, etc., is an Americanism which goes back more than 100 years—to 1837 at least. It is listed as a slang word in a number of special compilations or dictionaries of Americanisms, slang and colloquialisms, notably, an extensive work entitled "A Dictionary of American English on Historical Principles," published by the University of Chicago Press in 1940.

The noun **discombobulators**, derived from the verb, and used orally by General Creasy at a congressional hearing on the budget in regard to certain nerve-affecting chemicals, was viewed as a word especially appropriate for such application, and was so alluded to in an editorial in our January-February issue.—Editor.

DR. GIBSON IS HONORED BY CIVIC ORGANIZATION

Dr. Ralph E. Gibson, director of the Applied Physics Laboratory of Johns Hopkins University, Silver Spring, Md.; and a former vice-president of A.F.C.A., was recently honored by the Silver Spring Board of Trade. The Board presented to him a plaque citing him for "outstanding leadership in and encouragement of scientific research and development under his direction."

CAPT. BASS WINS A.F.C.A. PLAQUE

Secretary Roberts, of A.F.C.A. Headquarters, is sending the congratulations of the Association together with the handsome A.F.C.A. plaque to Captain Sampson H. Bass, Jr., Chemical Corps Headquarters, Materiel Command, Army Chemical Center, Maryland, for having enrolled eleven new members in the Association.

The plaque, made of brown plastic, with the crossed retorts insignia of the Association in blue and gold, is awarded to any member who enrolls ten new members.

Captain Bass states he finds recruitment of new members relatively simple once the advantages of Association membership are explained in a "personal interview."

GEORGIA TECH CHAPTER HONORS SCIENCE TEACHER

Georgia Tech Student Chapter President, Mr. Marion A. Clark, presents A.F.C.A. plaque to Miss Katherine A. Hertzka.

The Georgia Tech Chapter of A.F.C.A. presented the Association's Science Teacher plaque award to Miss Katherine M. Hertzka, Chairman of the Science Department at Hoke Smith High School, Atlanta, Georgia, at a dinner in her honor held at Brittain Dining Hall, on November 24.

Miss Hertzka was the Chapter's nominee for the National A.F.C.A. $1000 High School Science Teacher Award in 1958. As the Chapter's nominee, she received the Association's bronze plaque.

Miss Hertzka, selected for ability as a teacher and inspiration of students toward interest in science and mathematics, is a graduate of Agnes Scott College and Emory University. She has been at Hoke Smith High School for the past 20 years. She was recently selected by fellow teachers in Atlanta as "Teacher of the Year," and to compete in a statewide contest for that title.

MR. CONRAD J. B. HARDY HEADS A.F.C.A. PINE BLUFF CHAPTER

Pine Bluff Chapter Officers—Left to Right: Mr. Harvey O. Blackburn; President, Major William E. Sexton, and Mr. Conrad J. B. Hardy.

It was recently announced at Pine Bluff Arsenal, Arkansas, that Mr. Conrad J. B. Hardy, chemical engineer, First Vice President of A.F.C.A.'s Chapter there, would assume charge of the Chapter upon the departure (change of station) of the President of the Chapter, Major William E. Sexton, early in February. His new station is Fort Richardson, Alaska.

The other officers of the Chapter are Mr. Harvey O. Blackburn, Second Vice President, and Mr. Edward Woodford, Secretary-Treasurer.

The Board of Directors consists of Colonel Russell W. Dodds, Mr. C. J. Maupin, Major Hope W. Metzger, Major Bruno J. Jankowicz, and Mr. E. L. Schatz.

from

WITCO®

ULTRA Chemical WORKS

Emulsol

Metallic Stearates
Carbon Blacks
Sunolite®
(Anti-sunchecking wax)
Plasticizers
Asphaltic Coatings
Compositions,
Compounds,
Sealers,
Adhesives

Fungicides and Mildew proofing Agents
Thickeners
Napalm
Emulsifiers
Surface Active Agents
Detergents
Pthalic Anhydride

WITCO CHEMICAL COMPANY
122 East 42nd St., New York 17, N. Y.
Chicago • Boston • Akron • Atlanta • Houston
Los Angeles • San Francisco • London and Manchester, England

ARMED FORCES DAY—1959

ARMED FORCES DAY this year will be Saturday, May 16, but all during the week of May 9-17 the Army, Navy, Air Force, Marine Corps, Coast Guard and Reserve Forces will be "at home" at their stations in this country and overseas welcoming the public to military demonstrations and displays. Again this year the slogan for the occasion is "POWER FOR PEACE."

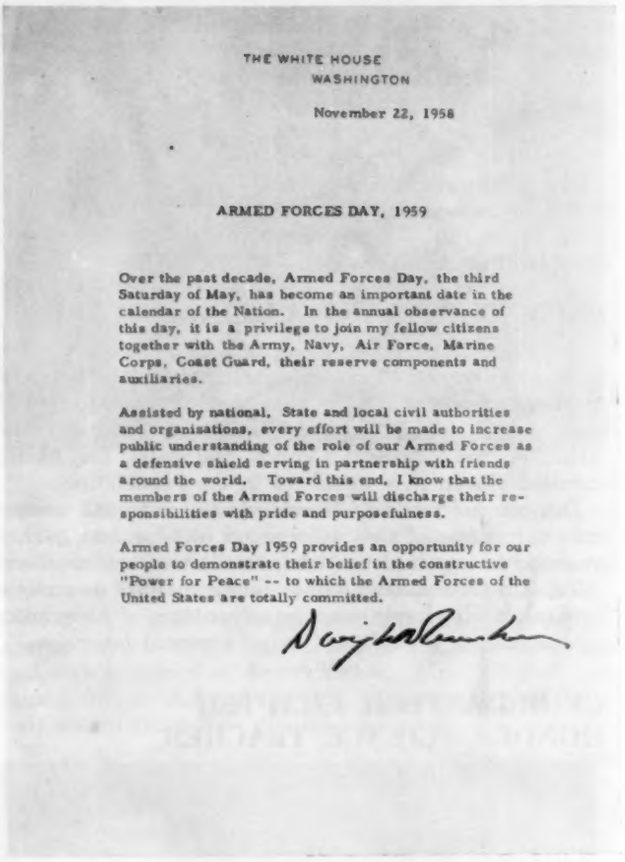
Printed herewith is a facsimile of President Eisenhower's announcement of the occasion this year and also a picture of the 1959 Armed Forces Day poster. This is described in the official statement by The Honorable Murray Snyder, Assistant Secretary of Defense for Public Affairs. In his announcement, he states, in part, as follows:

> "The 1959 Armed Forces Day Poster features a handclasp between the civilian and military, symbolizing the trust and understanding which must exist between members of our Armed Forces and those other Americans and free world friends with whom we stand for peace and progress. . . ."

Since the combined celebration by all the Armed Forces was inaugurated in 1949, the country has been divided into seven geographical areas for coordination of celebration activities. For each of these an Area Commander and an Area Project Officer has been assigned. The areas and their commanders and project officers are as follows:

AREA I (Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Wisconsin, Wyoming)

(Continued on page 39)



THE WHITE HOUSE
WASHINGTON

November 22, 1958

ARMED FORCES DAY, 1959

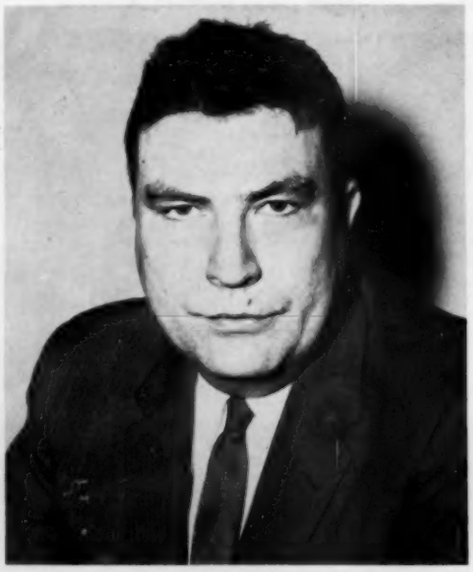
Over the past decade, Armed Forces Day, the third Saturday of May, has become an important date in the calendar of the Nation. In the annual observance of this day, it is a privilege to join my fellow citizens together with the Army, Navy, Air Force, Marine Corps, Coast Guard, their reserve components and auxiliaries.

Assisted by national, State and local civil authorities and organizations, every effort will be made to increase public understanding of the role of our Armed Forces as a defensive shield serving in partnership with friends around the world. Toward this end, I know that the members of the Armed Forces will discharge their responsibilities with pride and purposefulness.

Armed Forces Day 1959 provides an opportunity for our people to demonstrate their belief in the constructive "Power for Peace" -- to which the Armed Forces of the United States are totally committed.

Dwight D. Eisenhower

DR. HERBERT F. YORK APPOINTED DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING



Appointment of Dr. Herbert F. York to the new position of Director of Defense Research and Engineering was announced on December 4 by President Eisenhower.

Dr. York, born in Rochester, New York, received his A.B. in Physics from the University of Rochester in 1942. Graduating as Phi Beta Kappa scholar with honors, he remained as a teaching assistant and in 1943 obtained his M.S. degree. Dater that year, he joined the staff of the University of California Radiation Laboratory at Berkeley.

Between 1944 and 1945, Dr. York worked on the Electromagnetic isotope separation program at Oak Ridge, Tennessee. Returning to Berkeley, he entered hte University of California graduate school, and in 1949 received his Ph.D. in Physics. Later, in 1951, he became an assistant professor of physics. In 1950, Dr. York, a co-leader with Dr. Hugh Bradner, undertook the design and execution of a major diagnostics experiment for Operation Greenhouse at Eniwetok Proving Ground.

In July 1952, when UCAL expanded its research program to include weapons development and other classified programs, Dr. York was selected to lead the Laboratory program at Livermore, California. Later, he also became an Associate Director of California Radiation Laboratory.

Dr. York, on 15 March 1958, became Chief Scientist of the Advanced Research Projects Agency of the Office of the Secretary of Defense. He is presently a member of the President's Science Advisory Committee.

Industrial Chemicals • Agricultural Chemicals • Plastics • Magnesium

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

IMPROVING OUR CAPABILITIES FOR LIMITED WAR

By GENERAL MAXWELL D. TAYLOR
Chief of Staff, United States Army

(Following is the full text of the significant address by General Taylor before the thirty-fifth annual session of the Institute of World Affairs at the Huntington-Sheraton Hotel, Pasadena, California, on December 8, 1958. He states the meaning of the terms General War and Limited War; stresses his view that certain of our major military assets today, though essential to our national defense, are not directly applicable for Limited War, and proposes five-point program.)

This "snap" of General Taylor was taken at Army Chemical Center, Md., during his visit to the post in 1956.

I APPRECIATE very much the opportunity to appear before this distinguished gathering and to talk about a few of the significant aspects of national security which confront us. It is a pleasure for a soldier to be able to share this platform with the eminent speakers who have preceded or will follow me in dealing with your theme of "Agenda for American Action."

In choosing a topic for my discussion this evening, I have decided to talk about limited war, what it is, why it is important to understand, and what are some of the requirements to cope with it. This choice is made because of the recurrent debates over our readiness for this kind of threat which appear in current press and radio. In view of the complexity of our national strategy it is not surprising that there are some misunderstandings about the nature of the problems which deserve a few words of clarification. At the outset, let me define general war and limited war as they are ordinarily understood today. General war would be a direct armed conflict involving the United States and the Communist Bloc in which our national survival would be at stake. In a conflict of such magnitude it is probable that weapons of all sizes would be used with few limitations. It is depicted as an atomic fight to the finish by the two great power blocs.

If this concept of general war is accepted, the definition of limited war then becomes relatively simple—it is any military conflict short of a general war, one in which our national existence is not at stake. Thus, limited war covers a wide range of military operations, from a patrol action to armed combat on the magnitude of the Korean War or greater.

Cites Limited War Situations

IF I were asked why the growing interest in our ability to cope with limited war, I would say that it is because we have all noted the fact that they have occurred and are occurring—and in impressive numbers. In fact, a total of 17 limited war situations have arisen since 1945. They include a wide variety of military actions such as the Chinese Civil War, guerrilla operations in Greece and Malaya, the North Korean aggression, the Hungarian revolt, and the recent renewal of hostilities in the Taiwan Straits by the Chinese Communists.

Further, these have not necessarily been small or

short wars. By striking a statistical time-manpower balance of all 17 limited wars, one finds that they have averaged about 2½ years in duration and nearly 600,000 men engaged. Often, a very significant military effort has been required to bring these limited wars to an end.

Thus, in the past 13 years, there has been a notable incidence of active military operations short of general war. It is possible to pass from this fact to the inference that they will continue to occur and that the rate of occurrence may increase. This possibility arises from the fact that the Soviet leaders have always shown a willingness to take chances, even when they had no counterpart to our preponderant atomic strength. With the rise in their capability in the atomic and missile fields it appears possible that we may expect increasing intransigence on their part. We may well be required to respond to increased levels of provocation in an atmosphere of heightened international tension. We have seen evidence of growing Soviet belligerence at the time of the Syrian crisis last year, in the situations in Lebanon and during the recent incidents in the Taiwan Straits—all of which have been accompanied by Soviet threats of nuclear devastation directed at our allies and ourselves. The renewed pressure on Berlin is another case in point.

The sobering thought that both sides now have the capability of destroying each other should nuclear weapons be used without restraint is a hard fact of life with which we are going to live for the indeterminate future. Meanwhile, the Communists are well aware of the very material gains they have made in the past through limited forms of aggression. Therefore, in exploiting the fear imposed by mutual atomic capabilities it would appear quite likely that they will henceforth undertake to kick us harder and higher on the shins than they have done during the period of our atomic monopoly.

Discusses Assets For General War

At such a time it is well to take inventory of our resources and ask ourselves if we have the wherewithal to cope with the threat of limited aggression. I shall speak now only of our military assets, recognizing that our national assets are truly wider than the military; that our national strength is an aggregate of political, moral, and economic strengths as well as of military resources. However, for the purpose of our discussion I am going to talk primarily about military matters.

Approaching the problem from the negative side, I should like first to point out the military assets that we have which do not contribute directly to coping with limited war. For example, the power of our atomic retaliatory bomber and missile forces is so destructive that it is difficult to conceive of a limited situation in which they would be applicable. I make this observation while recognizing that forces of this kind are absolutely indispensable to deterring that general atomic war which it is our primary purpose to avoid.

By the same token, our expenditures for continental air defense—the interceptor planes of the Air Force and the surface-to-air missiles of the Army—do not contribute to our limited war effectiveness, notwithstanding their necessity for deterring or surviving in a general war. The early warning systems, while justified by the requirements of general war, will have no use in lesser situations.

The Navy has a warranted concern over the submarine threat arising from the build-up of the Soviet submarine capability. On the other hand it does not appear probable that antisubmarine warfare would play a significant part in a limited war. Thus, our assets in that particular field would not contribute primarily to a limited war capability.

Likewise, I would say that those activities which we group under the head of civil defense, although highly important and representing the expenditure of considerable money and effort at both Federal and state levels, do not contribute to limited war.

Indeed, most of our present atomic weapons systems may be of doubtful use in limited war, that doubt increasing in proportion to their destructiveness. In such wars, our normal role has been and probably will continue to be the provision of assistance to some friendly nation resisting some form of aggression. Under such conditions it will be important to rescue our friends with minimum damage to them and to their homelands.

GENERAL TAYLOR'S FIVE POINT PROGRAM

1. **Modernization of Appropriate Equipment**
2. **Improved Strategic Mobility of Limited War Forces**
3. **Pre-planned Use of Air and Sealift**
4. **Expanded Joint Planning and Training**
5. **Publicizing Limited War Strength**

Limited War Assets Considered

From what has been said thus far, it is apparent that we have a very impressive list of military assets which do not accord in any great degree with the requirements peculiar to limited war.

That is not to say that we do not have important assets which are directly applicable to limited war. Most of the Army and a large part of the Marine Corps are some of our assets. However, I would not say that the entire Army can be counted as a primary limited war asset, for in addition to our participation in continental air defense I mentioned earlier, a significant portion of our combat forces are deployed overseas, particularly in Europe. There they are involved in a defensive mission to deter or resist Communist bloc aggression in this area of deployment. While we can detach forces from Europe, as we did in the case of the airborne battle group which was sent into Lebanon last July, we would be reluctant to reduce our overseas deployment for use in limited wars outside their present location. The Army force specifically oriented toward readiness for limited war is the Strategic Army Corps, or STRAC, which is based in the United States, together with the back-up forces supporting its employment.

The Marines are also a definite limited war asset in their amphibious role. This fact was illustrated by their use in Lebanon, where Marine forces afloat moved in rapidly to seize the Beirut airfield and the port, preparing the way for Army elements coming in by air and water to expand the beachhead and to settle down for sustained ground combat if the need were to arise.

A great deal of the Tactical Air Command may be counted as a limited war asset, ready for rapid deployment overseas in similar manner as our Strategic Army Corps. So may be the Navy carrier forces, which can provide air support in peripheral areas where airfields do not exist ashore. Likewise, the long-range air and sealift furnished by the Air Force and Navy by which Army forces can be strategically moved about the world are a very important part of our limited war resources.

To summarize, I would say that a large part of the

Army, the Marines, the Tactical Air Command, some of the Navy's carrier forces, and the strategic airlift and sealift represent a rough tabulation of our principal limited war assets.

Problem Applies To All Services

HAVING identified what we have to work with, we may then ask, "Do we have enough?" I will try to answer this in two ways; first by discussing some specific situations short of general war, which are now history, and then by reference to some studies of hypothetical situations. In combination, such an examination should give us some insight into the adequacy of our means. Although I am going to speak primarily about Army forces, from what I have said thus far, it should be clear that there is no suggestion that limited war is an Army monopoly, but rather a problem which confronts all the Services.

Korea is the most conspicuous example of United States experience in limited war. It is interesting to reflect that the Communists could not have picked another spot on their periphery so favorable to U. S. military reaction as Korea. It was most fortunate that they chose an area in close proximity to our Japanese base, where we had forces—unprepared though they were—but at sufficiently close range to permit a rapid reaction. As we study possible areas of future limited wars, one doubts that the Communists will be so obliging the next time. In any event, although we did respond in time in Korea, it was clearly touch and go. We literally had to assemble our Army on the field of battle under the bullets of the enemy, and succeeded in welding it into an effective combat force barely in the nick of time to avert defeat.

The most recent experience in operations of the small-war type was our expedition to Lebanon, mounted at the request of the lawful government of that country. This operation was, from a technical military point of view, quite successful. By dint of careful advance planning permitted by adequate warning, all Services responded rapidly and reached their destination in an acceptable lapse of time. However, in addition to the advantage of adequate warning, the operation was made simple by the absence of a shooting situation at destination. Furthermore, the forces employed were limited in numbers. Thus, it is not prudent to draw general conclusions from our successful experience in Lebanon.

Because of the limited experience derived from actual cases, the Army Staff has undertaken a number of hypothetical studies of possible limited war situations where the United States might be involved. From these studies coupled with the experience of actual cases, four major conclusions have been developed.

Conclusions From Staff Studies

FIRST, the reaction time of U. S. forces should be improved. Next, this gain in time can be obtained in part by careful joint planning and training. Such training would include exercises involving elements of all Services to rehearse the organization, dispatch, and movement of task forces to destination. Third, many logistical obstacles to strategic mobility exist, similar to those encountered in Beirut, where a single airfield and restricted port facilities limited the rate of build-up of our forces ashore. Often these logistical bottlenecks have been viewed in the past as insurmountable obstacles to strategic mobility. My response is that if the leaders responsible for the development of naval power two hundred years ago had accepted the conditions of the harbors, ports, and facilities around the world as they found them, we would not be able to project our naval power abroad as we can today. We have now the same problem for the projection of land combat power, in conjunction with its supporting air and sea components.

Finally, we have determined from these studies that our limited war forces must have the most modern equipment. This equipment would include both conventional and low-yield atomic weapons and be characterized by lightness of weight and air transportability.

My conclusion then is that, although we now have a significant capability to cope with limited wars, we can and should take steps to improve it. So then the question becomes: "What should we do about it? What are these steps?"

My view is that we should embark on a "Five Point Program" to improve the capabilities of the Army and our sister Services to meet the possible challenges posed by limited war. The salient points of this program are: (1) the modernization of appropriate equipment; (2) the improved strategic mobility of limited war forces; (3) the preplanned use of air and sealift; (4) expanded joint planning and training; and (5) the publicizing of our limited war strength.

In speaking before the National Convention of the American Legion last September, the Secretary of Defense stated:

> "Our Army has been undergoing a modernization program designed to prepare it for the stepped-up requirements of today's or tomorrow's possible war, not yesterday's . . . This modernization program is by no means complete. We intend to push it vigorously."

In pursuance of Mr. McElroy's injunction, the Army intends to push its modernization along the following lines:

Explains Proposed Remedial Measures

DOLLAR-WISE, our problem is not a simple one. Approximately 60 per cent of the dollar value of the Army's inventory of equipment was procured during World War II or the Korean War; 10 per cent of it is of pre-World War II vintage. As a result, many items have reached a point where they are no longer economical to maintain or are incapable of meeting "the stepped-up requirements of today's or tomorrow's possible war." As a result we need to include second generation missiles, light atomic weapons, improved conventional weapons, and many new types of air and ground vehicles to advance tactical mobility. To direct and control our units and weapons we require improved, lightweight signal communications based upon newly designed radio equipment.

The modernization of our forces will tend to support our second point; improved strategic mobility. As the Army lightens its loads, we hope that our sister Services will modernize the sea and airlift upon which we depend for our strategic mobility.

As a part of our program to improve strategic mobility, we need to determine the logistical bottlenecks to mobility about the world which I earlier mentioned and endeavor to eliminate them. These can often be minimized by the forward stockage of supplies and equipment in critical strategic areas, to reduce the tonnages which must be transported in an emergency.

The third of our five points is the preplanning of the contingent use of a certain amount of air and sealift for possible limited war requirements. At present, the Army has no indications of the lift which would move its spearhead forces in an emergency. Some predesignation of air and sea elements for planning purposes would materially shorten the time required to get the initial forces

(Continued on page 39)

Chemicals you live by

Diamond produces the "Chemicals you live by"... for industrial and agricultural purposes, consumer use, and for our national defense. Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Basic Alkali Products
58% Light Soda Ash
58% Dense, Granular Soda Ash
Bicarbonate of Soda, U.S.P. Powdered, Granular
Bicarbonate of Soda Free-Flo*
Sesquicarbonate of Soda
Modified Sodas
Caustic Soda
Solid, Granular, Flake, Crystal
Liquid Caustic Soda
50% NaOH
73% NaOH
Liquid Caustic Potash
Foundry Grade Soda Ash
Soda Ash Briquettes

Chlorine
Liquid Chlorine
Single-Unit Tank Cars
Multi-Unit Tank Cars
Barges and Pipeline
Cylinders

Chromium Chemicals
Alumina Hydrate
Sodium Bichromate
Crystal, Granular, Liquid
Sodium Chromate
Potassium Bichromate
Chrome Salt Cake
Chromic Acid
Tanolins* (Tanning Salts)
Synthetic Tans
Tanning Oils and Fat Liquors
CPA 1800* (Chrome-Plating Additives)

Sodium Silicates
Silicate of Soda, Liquid
All Grades
Water White, 42°
Silicate of Soda, Concrete Special
Versilad* and Versilate* (Adhesives)
Silicate of Soda, Glass
Detergent Silicates
Moroc* Foundry Sand Binder
Sodium Metasilicate, Anhydrous
Sodium Metasilicate, Pentahydrate

Chlorinated Products
Muriatic Acid (Commercial and Water White)
Tank Cars
Anhydrous Hydrogen Chloride
Carbon Tetrachloride
Tank Cars and Drums
Chlorowax* 70 and 70S (Resinous Chlorinated Paraffins)
Chlorowax* 40, 50 and LV (Liquid Chlorinated Paraffins)
Perchlorethylene
Methyl Chloride
Methylene Chloride
Chloroform
Hexachlorobenzene
Hexachlorobutadiene-1, 3
Fire Extinguisher Liquid
Chloral
2, 4 Dichlorophenol
2, 4, 5 Trichlorophenol
2, 4, 6 Trichlorophenol
Benzene Sulfonyl Chloride
Parachlorobenzene Sulfonyl Chloride
Parachlorobenzene Sulfonamide
Phenoxyacetic Acid
2, 4, 6-Trichloroanisole
Ethylene Dichloride

Calcium Carbonates
Precipitated Calcium Carbonate Pigments for Paint, Rubber, Plastics, Glass and Printing Ink:
Suspenso* Surfex MM*
Millical* Multifex MM*
Non-Fer-Al* Super-Multifex*
Carbium Kalite*
Surfex* U.S.P. Dense

Cement and Coke Products
Portland Cement
Masonry Cement
High Early Strength Cement
Waterproof Gray Cement
Foundry and Industrial Coke
Benzol
Toluol Xylol
Crude Ammonia Tar

Detergents and Chemicals for the Laundry Industry
Laundry Soda
Diamond Soda Crystals
Laundry Sours
Laundry Liquid Blue
Hi-Ratio Silicate*
Hydrobreak*
Hydrolate*
Paralate* Paralate*S
Alkalate* Metalate
O & W Compound*
Ortholate
Sodium Metasilicate, Anhydrous
Sodium Metasilicate, Pentahydrate
Sodium Orthosilicate
Sodium Supersilicate
Suspensoil
58% Soda Ash
Washroom Control Kit

Industrial Cleansers and Chemicals for the Food, Dairy and Beverage Industries
Aquid* (Liquid Detergent)
Bomber* (Dairy and Creamery Detergent)
Cirkal* (for Mechanical and Circulation Cleaning)
Citrospeed*
Cleaner and Cleanser
Diamid* (Liquid Acid Cleaner)
Diamond Soda Crystals
Dreadnaught* Cleaner
Economy Cleaner
Special Alkalies (Causticized Ash, all strengths)
Special Alkalate
Hardnox Alkali* (Bottle Washing)
Hi-Speed* Cleaner
Hi-Test Alkali* (Bottle Washing)
Horizo* (Chlorinated Phosphate-Type Sanitizer)
HW Soaker Alkali* (Bottle Washing)
Diamond Detergent
Hydrolate*
Hydrobreak*
All-Purpose "W"* Cleaner
Compounds for Specific Uses
Modified Soda
BB Soaker Alkali (Bottle Washing)
Clipper Cleaner*
CH-100* and CH-101 (Bottle Washing)
Powdered Acid Cleaner
Pre-Mix Tank Washing Compound
Samson* Can Washing Compound
Sequet* Sesquilate*
Neutral 50* Cleaner
Nu-Met* Nutralac

Agricultural Chemicals
DDT (Technical and Concentrates)
BHC (Technical and Concentrates)
2, 4-D (Acid, Salts, Esters, and Formulations)
2, 4, 5-T (Acid, Salts, Esters, and Formulations)
Lindane (100% and Concentrates)
Miticide K-101 (Technical)
Hexachlorobenzene (Technical and Formulations)
Grain Fumigants
Dacfia
Diamond "80-20"*
Diamond Premium Brand

Plastic Resins and Compounds
Polyvinyl Chloride Resins
Diamond PVC-50 (High Molecular Weight—U.L. Approved)
Diamond PVC-45 (Medium Molecular Weight)
Compounds
Diamond Compound R4 (for Rigid PVC Applications)
Compounds for Specific Applications

Other Diamond Chemicals
Di-Aqua* (Wetting Agent)
Hydrogen

**Reg. U. S. Pat. Off.*

Diamond Chemicals

11th Armored Cavalry Regiment tanks moving through Tauberbischofsheim during exercise Sabre Hawk.

OUR ARMY IN EUROPE

The Lebanon expedition together with extensive field exercises and organizational changes, as well as various extra-curricular programs made 1958 one of the busiest years for Seventh U.S. Army as shown by report from Germany herewith.

VAIHINGEN, Germany—Highlighted by the Lebanese crisis which demonstrated the combat-readiness of the Seventh United States Army, the year 1958 saw the complete conversion of the "Shield of NATO" to pentomic concepts and the reshuffling of its power to meet changing demands for the defense of free Europe.

In mid-July, an airborne brigade from the 24th Infantry Division, with Seventh Army support elements, was ordered by the President of the United States into the key Middle East country of Lebanon. At the request of the president of that beleagured country, the airborne task force combat loaded into airborne troop carrier aircraft and took off for Lebanon, ready to jump, if necessary. They became the Army portion of the joint American military force.

With their rapid staging, well-organized movement and professional performance from the initial alert for movement to their final return to the Seventh Army command, the troops successfully resolved the question of their combat readiness, both for the watching world and themselves.

However, Lebanon was only one of the many factors that made 1958 one of Seventh Army's busiest years. The 365-day period saw a new commander installed, the establishment of a support command initially consisting of 25 technical units, the addition of a new missile to the Seventh Army arsenal, and the staging of Exercise Sabre Hawk, the Army's largest postwar maneuver.

Exercise Sabre Hawk, which took place in early February, placed over 125,000 American troops in the field. High military observers and newsmen from most of the NATO countries, Asia and Europe were on hand for the problem. They were in agreement with Lieutenant General Bruce C. Clarke, then-Seventh Army Commander, when he summed up Sabre Hawk as "an extremely well-run, beneficial field exercise."

Exercise Sabre Hawk was General Clarke's last major venture into the field as commander of Seventh Army. In July, shortly before airborne troops were destined to fly to the Mediterranean, Lieutenant General C. D. Eddleman took command of the Seventh, saying, "My job will be to see that this command's combat readiness is maintained and improved as new techniques and equipment become available."

In a move designed to bolster Seventh Army's defenses and to provide the latest in missile support, the first unit equipped with the Army's "Redstone" arrived in Germany. The 40th Artillery Group came to Europe aboard the same troopship which brought General Eddleman.

In a major move to modernize Seventh Army, the

Seventh Army Support Command was established at Mannheim/Kaefertal under the command of Brigadier General Stephan Mellnik. Administrative and technical service units in the Seventh Army were assigned to the Support command for administration, leaving Seventh Army headquarters free to concentrate on operational matters.

At the conclusion of the Lebanon activities, Major General Paul D. Adams, American Land Forces commander, returned to Europe and became head of the Support Command and Seventh Army Deputy Commander. Previously he had been commanding general of the Northern Area Command.

The face of Seventh Army changed during 1958.

The shoulder patch of the 11th Airborne Division disappeared and was replaced by the Taro Leaf of the 24th Division. Same men, same units, except that the 24th was an integrated infantry-airborne unit with both jumpers and ground troops in one headquarters. Later in the year, the 8th Infantry Division began the same changeover.

Packing up their shiny boots, swagger sticks and instructional aids, the Seventh Army Noncommissioned Officers Academy left Munich after nearly a decade and moved to Bad Toelz where they are once again open for business.

One lone WAC joined the combat ready army during 1958. Chief Warrant Officer Margaret Finnegan arrived and assumed duties as secretary to General Eddleman—the only WAC entitled to wear the Seventh Army patch.

Seventh Army was also active in a non-military sense, making friends and building good relationships throughout West Germany.

More than 40,0000 orphans and underprivileged youngsters in the 160-odd German communities housing Seventh Army units received soldier support during the year, in the form of parties, gifts or monthly donations to sponsored homes or hospitals.

The Seventh Army Symphony (under a new conductor, Sergeant Edward Lee Alley) toured the Benelux countries, journeyed to the World's Fair in Brussels and drew applause from audiences and critics for performances at the American Pavilion.

The Seventh Army Soldier Symphony Orchestra performs in the American Pavilion at the Brussels World Fair. Directing is Sergeant Edward Lee Alley. The performance climaxed an international tour by the soldier-musicians.

The Symphony also continued its concert series in Germany, playing before full houses in many major cities and dozens of smaller towns.

Dr. Hans Hoerner, musical director of the Stuttgart Philharmonic, was guest conductor for one Seventh Army Symphony concert.

Climaxing the command's good relationships program for the year was the receipt of the Silver Anvil Award, the highest presentation made by the American Public Relations Association. The association hailed the Seventh Army's work in the field of international relations originating outside the U.S. as "outstanding."

Seventh Army soldiers also excelled in another field of international activity. The 34th Infantry, 24th Division won the International Prix Leclerc marksmanship matches, setting a new record and taking the title away from France, the 1957 winners.

Sponsored this year by the United States, the Leclerc

LEBANESE LUNCHEON—Watermelon-munching is an international language, as this Seventh Army soldier, Specialist Fourth Class Byron F. Sprague, Jr., from Portland, Oregon, learns while sharing his juicy tidbit with youngsters in Lebanon.

TO THE ATTACK—Seventh Army infantrymen spring from their H-34 helicopters for a surprise attack behind "enemy" lines during Exercise Sabre Hawk, in February 1958. More than 125,000 troops took part.

match was held at Grafenwoehr and was the culmination of the Seventh Army and USAREUR 1958 marksmanship program.

Away from training, command soldiers worked hard at setting a different type of record. The Seventh Army index of serious incident frequency, or "crime rate," plunged to an all-time low of 0.47 per thousand soldiers in September. This meant that only one soldier in every 2,060 was involved in a crime of violence or serious offense against military law. At year's end, Seventh Army had its lowest annual crime rate since reactivation, an average for the year of less than 0.60 per thousand.

At the close of 1958, approximately 75 per cent of all Seventh Army soldiers were taking part in the command's savings program, putting money in either Soldiers Deposits or U.S. Savings Bonds.

Seventh Army had set the goal at 65 per cent participation in '58. This was reached in February with the year barely begun, when 65.48 per cent of the troops were investing their money in the savings program. By October the percentage was up to 76.23.

While showing concern for their money, Seventh Army troops did not neglect the worthwhile charities that asked for contributions during the year.

Seventh Army troopers donated $429,617 to the four organized drives held within the command. The Army Emergency Relief campaign topped the list of successful campaigns, receiving $143,326 in contributions.

The faculty of the Seventh Army Noncommissioned Officers Academy led the per capita tabulations, giving slightly less than $10 per man in the four drives.

Soccer once again played a large role in the Seventh Army sports set-up. Army booters met and held their own against German soccer squad and Seventh Army men formed the backbone of the U.S. CISM eleven that played creditably against Belgium and Portugal.

On the local international level Seventh Army fencers, swimmers, boxers and wrestlers competed against German clubs and did a great deal to strengthen the good will prevalent between the citizens of West Germany and their Seventh Army "guests."

In the 10th annual Bad Hersfeld track and field carnival, held in August, Seventh Army athletes downed a strong Land Hessen squad, maintaining their supremacy in this decade-long track and field tradition.

All-year long, Seventh Army schools kept turning out men better-trained to keep the command combat-ready. The Tank Training Center at Vilseck graduated its 20,000th student and celebrated its ninth anniversary. The Seventh Army Noncommissioned Officers Academy (which only lost two weeks of class time moving to Bad Toelz) pushed its graduate roster past the 40,000 mark and qualified parachutists began popping out of the 24th Division's jump school.

Nineteen fifty-eight was a year when even the relatively small things were great.

Seventh Army Engineers from the 498th Engineer Battalion broke their own record for bridging the Rhine River when they put a 780-foot long vehicle bridge across the big stream in two hours, four minutes.

In Europe, as well as in Lebanon, the Seventh United States Army in 1958 demonstrated its high state of vigilance and combat readiness.

(Shortly before press time came the news that General Eddleman has now been reassigned to command of all United States Army Forces in Europe.—Ed.)

NEW ARMY COMMANDER IN EUROPE

LT. GEN. CLYDE DAVIS EDDLEMAN

General Eddleman, the new Commander of the U.S. Seventh Army in Europe, was just previous to that assignment, serving in the Department of the Army as Deputy Chief of Staff for Operations.

General Eddleman was born in Orange, Texas, on January 17, 1902. He was graduated from the U.S. Military Academy in June 1924, and commissioned in the Infantry. Many of his varied assignments during his subsequent career have been on Operations, or G-3, duty. In World War II he served as Assistant Chief of Staff G-3, under General Walter Krueger, of the Sixth Army in the Southwest Pacific and in the occupation of Japan.

Among his assignments since the war was that of Commander of the Fourth Infantry Division in Europe. General Eddleman received promotion to brigadier general in 1944; to major general in 1951, and was made lieutenant general in 1955. Previous to his last General Staff assignment in Washington, he served as Commandant of the Army War College, Carlisle Barracks, Pennsylvania.

General Eddleman's decorations include the Distinguished Service Medal, the Silver Star, the Legion of Merit, the Bronze Star, and the Philippine Distinguished Service Star.

Palladium Ammonium Chloride, Palladium Black
Diammine ... Palladium ... ide Diam
oxime, ... Monosu
Palladium Oxide, ... Palladous
Aldehyde, Palmitoleic Acid, Palmitoyl Chlori
... Powder, Pancreatin, Panthenol, Pant
... Gl... tain, d
Pectinolytic Enzymes, Pellidol, ...
Pentaacetyl-d-glucononitrile, ...
Penta... chlo... dec... to...
OVER 20,000 CHEMICALS IN STOCK!
Write for Our New 138-Page Catalog!
DELTA PIONEERS IN CHEMISTRY
DELTA CHEMICAL WORKS, Inc.
23 West 60th St. New York 23, N. Y. PLaza 7-6317

CAMEL GAS MASK REMINISCENT OF NORTH AFRICA IN WORLD WAR II FEATURED IN MUSEUM DISPLAY

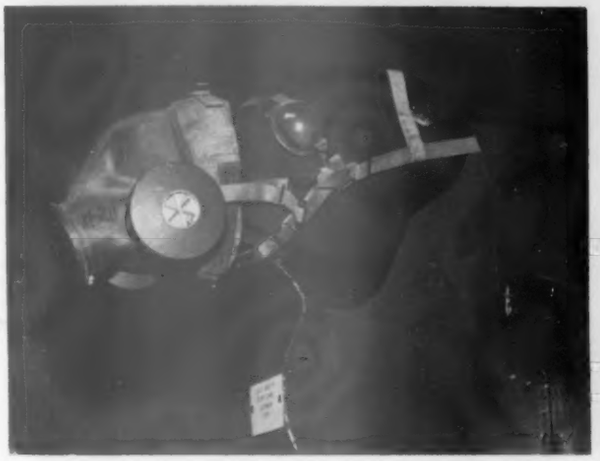
THE PICTURE on the Front Cover of this issue of THE JOURNAL, showing the head of a camel equipped for defense against gas attack is from a negative found in a German Army chemical warfare school and museum, near Celle, Germany, at sometime during the latter part, if not the very closing phase of World War II.

The photographic negative recently came to the notice of the public information authorities at Army Chemical Center in connection with the making of a photograph of a German camel gas mask mounted on a wooden mockup of a camel's head, part of the captured equipment display at the Chemical Corps museum at the Center. A photograph of that camel mask, as well as a pair of camel goggles adjusted to the mockup, is shown herewith.

Horse and dog gas masks were familiar items in World War I, but, insofar as known to THE JOURNAL, this presumably World War II item is the first mask ever designed especially for a camel.

There are two rather interesting stories connected with this camel mask.

First, is that of the discovery of the mask. It appears that the mask as well as the photographic negative referred to were among some 5000 items of German Army equipment which fell into the hands of the British forces when their troops overran the German Army Chemical Warfare School and Museum, near Celle, Germany. According to the story, as it is understood at Army Chemical Center, the British were about to destroy the school and museum and their contents when there suddenly appeared on the scene an American Chemical Officer (identity not known) who, perhaps with an eye to history, persuaded the British to preserve the equipment and then obtained permission to have all of it shipped to the United States for further study and retention. It appears also, according to the story, that this material, after shipment to this country, lay unattended in some depot in the South for two years,



finally sometime in 1947 being removed and shipped to the Chemical Corps Museum at Edgewood, Maryland.

It is believed that the mask was especially designed for use of the Africa Korps, the German desert forces under Rommel, which long held sway in North African operations.

The picture shown on the Cover appears to have been taken at some desert oasis, as indicated by the palm trees at the lower left corner.

It has been suggested that perhaps the American Chemical Officer responsible for obtaining this equipment for the Chemical Corps Museum may read this article and make known his identity.

The other rather interesting story about this mask is that recent interest in it is due largely to a group of some 160 boys of Prince Georges Maryland Branch of the Washington, D. C., Y. M. C. A., who were guests of the Chemical Corps installation some months ago. Among other "events" which were arranged for them was a look-see at the Museum. The boys were fascinated with the camel mask display and their visit including an allusion to the mask was the subject of a Chemical Corps news release.

TO THE BRASS WHO DEMANDS INSIDE INFORMATION

ABOUT GAS MASKS

We Challenge You To Buy One of Each Manufacturers Facepiece

WEAR EACH AN HOUR ——— AND GET THE REAL FACTS

From the Inside ——— Acme CM-601-10 Gives:

NO DISTORTION! Due to Flat Lenses!

LESS FOG! POSITIVELY! Patented Jet Air Valves direct ALL of the incoming air against the lense

WIDER VISION ANGLES! DEFINITELY! Upward—fewer bumped heads. Downward—less stumbling and falling

SAFER FIT! Greater rubber area touches your face—Softer—No pressure points

CENTER FLEXIBILITY! Adjusts to Narrow or Wide faces with less harness pull.

ACME PROTECTION EQUIPMENT COMPANY

1241 Kalamazoo St., South Haven, Michigan

CHEMISTRY AT WORK FOR THE U. S. ARMY

By MAJOR E. M. GERSHATER, CMLC
United States Military Academy
West Point, New York

(The following article dealing with some of the military applications of chemistry has been prepared by Major Gershater from a lecture delivered to the Third Class cadets, United States Military Academy, at the conclusion of their instruction in Chemistry.

Major Gershater is assigned as Chemical Instructor in the Department of Physics and Chemistry.

A number of the applications of chemistry described here by the author have previously been dealt with in other articles by different authors in various issues of THE JOURNAL. It is believed, however, that this compilation of representative examples by Major Gershater not only provides interesting reading but will probably serve useful purposes as a condensed single reference.)

THE ALCHEMISTS of ancient days devoted much time and energy—in vain—to an attempt to transform the "base" metals into gold. By means of modern nuclear technology, it is now possible to do this, at a cost far greater than the worth of the product. But this is not the chemical transformation of significance to today's Army: the value to the modern Army lies rather in the transmutation of scientific facts and principles from abstruse, although interesting, scientific curiosities into practical end-items useful to the troops in the field. While the Army may have relatively little need for theoretical, ivory-tower chemistry, it has *great* need for the products generated by application of chemistry to the problems of the fighting forces. The validity of this assertion can be demonstrated, chapter and verse, by examination of several representative examples.

Nylon Body-Armor

EVEN prior to the outbreak of hostilities in Korea, in 1950, research was being conducted on the effectiveness of various types of body armor-material. One material tested, for example, was Hadfield steel, .08 of an inch thick, but—as might well have been expected—this material proved far too heavy for incorporation into a vest which a man could wear in combat. The commencement of action in Korea naturally accelerated this research effort.

Study of the casualty figures early in the Korea conflict had revealed several provocative facts: (1) almost 92% of all wounds sustained were those caused by artillery shell fragments, as opposed to small arms and other causes; (2) about 73% of all wounds proved to be of the "entrance-but-no-exit" type, a rather important observation which strongly suggested that most of the wounding fragments were of comparatively low velocity; (3) of those soldiers either directly killed in action or who subsequently died of wounds received in action, over 71% were directly attributable to wounds received in the thorax or abdomen.

These facts led inescapably to the conclusion that a lightweight armor vest covering the thoracic-abdominal regions of the body would be a highly desirable item, which would contribute markedly to a reduction in casualties. Accordingly, developmental work was accelerated—personnel of the Chemical Corps, Medical Corps, and the Quartermaster Corps made important contributions to this work—and vests were produced of nylon and a fiberglass material called "doron". Doron consists of some 15 or 16 layers of glass-fiber woven cloth impregnated with a thermosetting resin, bonded together under heat and low pressure. Fitted into a vest arrangement, it is strong and resistant to shell splinters, yet is relatively lightweight and comfortable.

After final engineering tests, the vest was standardized, procured in quantity, and issued to the front-line troops in Korea. Immediately thereafter, the number of deaths of soldiers wounded in the thoracic or abdominal regions of the body diminished by over 41%. In addition, there can be little question of the improved confidence and fighting-spirit of the soldiers wearing the vest. Instances were reported where men fell on live grenades, resulting in their vests being almost completely destroyed, without their sustaining a wound. Figs. 1 and 2

Major Gershater was originally commissioned in the Infantry in 1942, and served in that branch in World War II. In 1949, he transferred to the Chemical Corps. Before his present assignment at West Point, he had served as an instructor in atomic energy and radiological defense at the Chemical Corps School, and later, as Assistant Executive Officer in the Office of the Chief Chemical Officer. He is a graduate of the Infantry School, Military Counterintelligence School, the Chemical Corps School, and the Command and General Staff College. He received his college education at the University of Nebraska and the University of Maryland, and has Bachelor and Graduate degrees.

Outside of Army nylon vest showing hits from shell fragments.
Fig. 1

Inside of same vest showing fragments were stopped before they could penetrate vest.
Fig. 2

show the outside and inside of a vest worn by a soldier in an artillery impact-area in Korea. The vest proved, not too surprisingly, extremely popular with the troops; they wore them constantly, even in the hottest weather, and as one grizzled combat veteran expressed it, "I would far rather wipe sweat than blood."

Even discounting the introduction of the armor vest, the overall percentage of deaths among soldiers *after admission to a medical treatment facility* had been reduced to the vicinity of 2.5%. This impressive figure is due in large measure to improved surgical techniques, vital time saved by helicopter evacuation of the wounded, and the relative accessibility of the Mobile Army Surgical Hospital to the front lines. Any further marked reductions in combat deaths can likely occur only among the category "killed in action, outright, on the battlefield." To this end, the nylon armor-vest may well prove to be, in any future hostilities, the new form of preventive medicine needed to reduce to an absolute minimum the number of men killed in action.

Vertical Smoke Curtains

SMOKE has, upon numerous occasions, proved itself a valuable and versatile tactical weapon. During World War II, for example, smoke-screens formed by aircraft were utilized in all theaters of war to conceal tactical targets from enemy view and observed fire. A striking and representative example of the use of protective smoke for this purpose was the screen laid down by aircraft during the paratroop-drop at Lae, New Guinea, early in the war. However, toward the latter months of the war, the speed of aircraft had increased considerably: this created a most serious problem in the dissemination of smoke-screens from aircraft wing-tanks, for the laws of cloud physics dictated that the rush of air past the tank orifice caused the released agent to break up into tiny droplets and hang suspended in the air, instead of falling to the ground as desired, to form a vertical protective curtain. Even in those instances where the screen *was* formed, it habitually contained undesirable gaps. The problem, therefore, has been to obtain a uniform screen from ground level up to a height sufficient to afford complete obscuring effects.

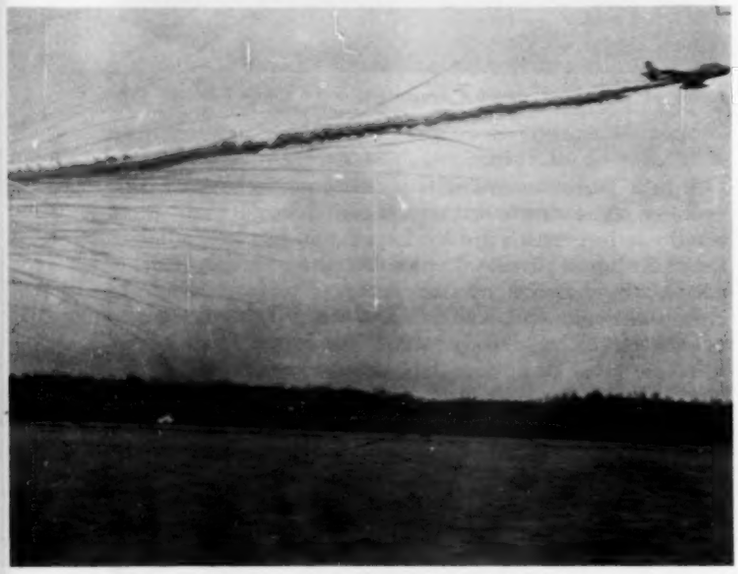
A new munition under study may entirely solve this problem. The munition consists of a large number of small carriers which are loaded into an airplane smoke-tank. A liquid smoke known by the symbol "FS" is added. FS, chemically, is a solution of sulfur trioxide in chloro-sulfonic acid, materials which are readily available and relatively inexpensive. The liquid FS not only fills the small munitions but, acting as a "free agent", also fills the spaces between these small carriers, thus leaving a minimum of dead space in the tank.

When the tank functions, two effects occur simultaneously: the free agent forms an airborne cloud, and the small carriers fall to the ground. As the carriers drop, liquid FS is released through ports in the munitions, forming lateral streams of smoke (Fig. 3). Upon contact with the ground, the remainder of the munitions continue to emit smoke, thus initiating a cloud at ground level (Fig. 4). In all, therefore, there is a cloud at release height, a cloud at ground level, and a connecting section (Fig. 5). The result is a solid vertical smoke-curtain, with no undesirable gaps or thin areas. In tests which have been conducted, it has proved possible to generate curtains such as that depicted in Fig. 5, from start to finish, in just under 30 seconds. Hopefully, development and standardization of this type of munition will assure the troops in the field of a rapid and effective method of establishing vertical smoke-curtains whenever the tactical situation requires.

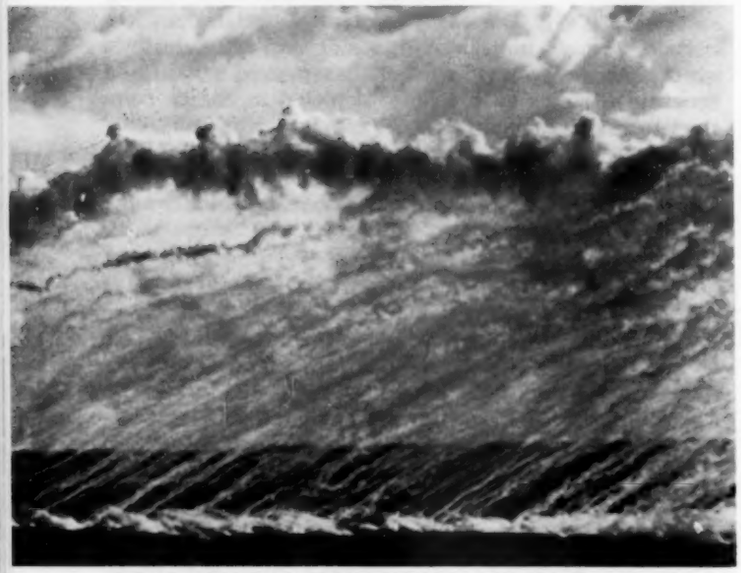
Flame and Incendiary Weapons

DURING the closing months of World War II, the massive B-29 raids on Japan dropped thousands of tons of bombs on Tokyo and other important cities of the island empire. A little-known fact about these raids is that about 85% of the tonnage dropped on these targets consisted of incendiary-type weapons. Most of these were of the so-called "intensive" type, which delivered a very great amount of heat in a relatively concentrated area. The heat is derived from a heat-producing chemical reaction between ferric oxide and elemental aluminum, the mixture known as "thermite". Expressed in the language of the chemist:

After wing-tank is functioned an airborne cloud is formed at release height and the tiny smoke-carriers fall toward ground, some opening to form lateral streamers of smoke.
Fig. 3



As the carriers drop, the intermediate section of the cloud thickens and widens and ground layer begins to form.
Fig. 4



Top, intermediate and ground layers of cloud merge to form solid curtain of smoke in matter of seconds.
Fig. 5

$$\underbrace{Fe_2O_3 + 2\,Al^\circ}_{\text{Thermite}} \rightarrow Al_2O_3 + 2\,Fe^\circ + 202{,}000 \text{ calories,}$$

and it is this heat of reaction, magnified many times by the vast tonnage of munitions utilized in the raids, which burned the cities of Japan to the ground and unquestionably contributed significantly to the lessening of the Japanese national will to continue the fight.

There is also a need for a tactical flame weapon which can be used to attack bunkers, pillboxes, small structures, individual tanks, and similar targets. This need is filled by the Portable Flame Thrower (Fig. 6) and by the Mechanized or Tank-Mounted Flame Throwers. The fuel burned may be gasoline, Diesel oil, or essentially

A 4th Infantry Division STRACman at Fort Lewis, Wash., fires the Army Chemical Corps' portable flame-thrower. Jets of thickened gasoline fired at ranges up to 60 yards penetrate bunkers or pillboxes, curl around corners, and kill or flush the enemy into the open.
Fig. 6

any low molecular-weight hydrocarbons, formed into a colloidal gel by the addition of a suitable thickener-compound. The material formerly used contained the sodium salt of palmitic acid, from which the name "Napalm" was derived ("Na", the universal chemical symbol for sodium, itself derives from "Natrium", the Latin name for this active metal); currently, however, better thickeners are available, yielding more stable gels. The gelled gasoline is ejected under pressure from the fuel-tanks, ignited upon exit from the flame-gun, and directed against the target, where it sticks and burns. By varying the percentage of thickener used (generally between limits of about 3% and 8% thickener, by weight), it is possible to vary the quality of the flame produced from a hot, billowing, scorching type flame of short duration to an adhesive, persistent flame of lower temperature but considerably longer duration. Incomplete combustion of the hydrocarbon-fuel usually results in the formation of a dense, black cloud of elemental carbon particles, instead of the completely gaseous products of combustion ideally expected.

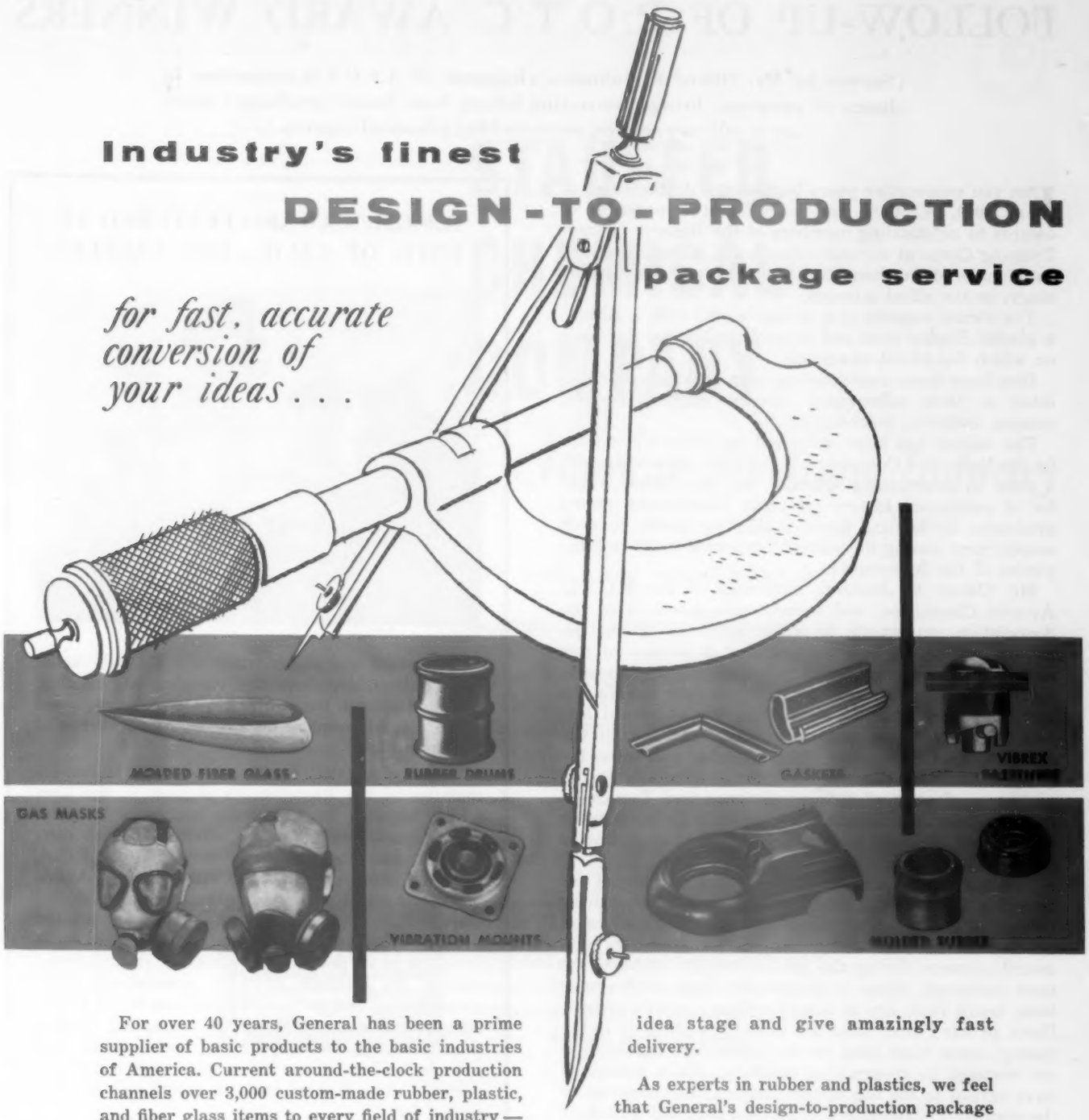
Combustible Artillery Shell-Cases

A CHEMICAL project currently under study by the Ordnance Corps involves the substitution of plastic for the brass currently used in artillery shell-cases. Ideally, the plastic shell-case will be completely con-

(Continued on page 32)

Industry's finest DESIGN-TO-PRODUCTION package service

for fast, accurate conversion of your ideas . . .



For over 40 years, General has been a prime supplier of basic products to the basic industries of America. Current around-the-clock production channels over 3,000 custom-made rubber, plastic, and fiber glass items to every field of industry — automotive, aircraft, petroleum, household and electrical appliances, communications, textile, heavy machinery, and the military.

The backbone of this vast operation is an unusually large staff of engineers, designers, researchers, and development men. Working with the finest mechanical facilities in the business, these specialists can take your product in the idea stage and give amazingly fast delivery.

As experts in rubber and plastics, we feel that General's design-to-production package is the best possible combination of talent and ability-to-produce.

- Extruded Rubber
- Molded Rubber
- Latex Foam
- Urethane Foam
- Extruded Plastic
- Polyester Glass Laminates
- Silentbloc Machinery Mounts
- Silentbloc Bushings, Bearings
- Silentbloc Instrument Mounts
- Vibrex Fasteners
- Glass-Run Channel
- Rubber-to-Metal Bonding
- Rubber-Metal Assemblies
- Oil and Hydraulic Seals
- Hydraulic Brake Parts
- Lathe-Cut Parts
- Die-Cut Parts
- Metal Stampings
- Molds, Dies, Tools, Jigs
- Custom Metal Fabrication

Industrial Products Division GENERAL THE GENERAL TIRE & RUBBER CO.

For additional information on General's diversified products and services, write to: The General Tire & Rubber Company, Industrial Products Division, Wabash, Indiana.

GENERAL TIRE & RUBBER CO.

Industrial Products Division • WABASH, IND.

FOLLOW-UP OF R. O. T. C. AWARD WINNERS

(Survey by Mr. Oliver F. Johnson, chairman of A.F.C.A.'s committee in charge of program, brings interesting letters from recent graduates; many are in military service, some seeking advanced degrees.)

FOR TEN consecutive years beginning with the summer of 1949, A.F.C.A. has carried out a program of awards to outstanding members of the Reserve Officers Training Corps at various colleges and universities who have majored in chemistry, chemical engineering, biology, or the allied sciences.

The award consists of a bronze medal with a ribbon, a plastic display case and a scroll indicating the basis on which the award was made.

How have these young college men fared since graduation in their subsequent careers—military service, science, industry, teaching, etc.?

The matter has been discussed on various occasions by the Executive Committee of A.F.C.A., especially with a view to ascertaining whether the Association might be of assistance to any of these outstanding young graduates by helping them, if they so desire, to seek employment among the various corporate member companies of the Association.

Mr. Oliver F. Johnson, chairman of the R.O.T.C. Awards Committee, and former vice-president of the Association, undertook to make inquiries among the award winners. It was evident that a project of this sort would be one of considerable magnitude. Accordingly, he decided to confine it to winners during the last five years—that is, since 1954. He addressed letters to the colleges and universities enrolled in the A.F.C.A. Award Program (27 in number and to be increased to 47 for the 1959 program)—generally to the various professors of Military Science and Tactics on duty at these institutions—seeking their cooperation in sending on requests for information to the graduates concerned.

This survey has already resulted in a number of interesting replies. It is realized, of course, that address listings of graduates in college files are not in all cases up-to-date, so that a number of the graduates and award winners during the period considered have not been contacted. Many of the award winners who have been heard from are in active military service, Army, Navy, or Air Force; some are already established in industry; some have gone on for advanced degrees, and are engaged in research or teaching. Those contacted have agreed to the use of their letters in publication of the survey. Mr. Johnson, for his own part and on behalf of the Association wishes to express through THE JOURNAL his thanks and appreciation both to the colleges and universities concerned, and to the award winners who have replied to the inquiry, for their cooperation.

The A.F.C.A. program of awards to outstanding R.O.T.C. students in the chemical and allied sciences field is in line with the long-standing and continuing policy of promoting the development of scientific manpower to meet the nation's needs. The Association, through its headquarters and R.O.T.C. Awards Committee, will seek to be of assistance to the R.O.T.C. medal award winners, when requested, in seeking suitable employment among A.F.C.A's Group and Sustaining Member companies.

In some cases the Association has already been instrumental in assisting award winners in respect to employment in industry or military service.

A.F.C.A.'S AWARD FEATURED AT UNIV. OF CALIF., LOS ANGELES

The award and presentation of A.F.C.A.'s medal to an outstanding chemistry, chemical engineering, or allied science student has come to be regarded as an annual event of considerable importance at the institutions concerned.

It is the practice, insofar as possible, to have a member of the Association's chapter in the area which includes the University concerned to make the presentation. Of much interest in that connection was the presentation of the A.F.C.A. medal at the University of California, Los Angeles, at Awards ceremonies and review of the Corps of Cadets on January 15 last. A printed program for the occasion with scenes of cadet activities was provided. A number of important awards by various patriotic associations were made. Listed last on the program was the A.F.C.A. ribbon and medal, and it was interesting to note that the program stated that the medals and awards "will be presented in inverse order of importance. The highest ranking award will be presented last."

The A.F.C.A. winner on this occasion was Cadet Lt. Colonel Kenneth K. Dixon. The presentation was made by Colonel Samuel P. Pickett, CmlC, USAR, president of A.F.C.A's Southern California Chapter.

In the picture herewith Colonel Pickett is shown decorating Cadet Colonel Dixon.

Following are excerpts or brief descriptive paraphrasing from one batch of the many letters received. Many more of these letters are being prepared for publication in the May-June issue of THE JOURNAL. For convenience, letters presented here have been grouped in conscutive order of the year in which the awards were made, beginning with 1954:

(Continued on page 28)

STAUFFER CHEMICAL COMPANY

A Major Source of Basic Chemicals for Basic Industry

We have many opportunities for chemists and chemical engineers in research—organic and inorganic—in manufacturing and in sales.

Stauffer CHEMICALS SINCE 1885

STAUFFER CHEMICAL COMPANY

380 Madison Avenue, New York 17, N. Y.
Akron • Chicago • Houston • Los Angeles
• Oakland • Omaha • North Portland, Ore.
• San Francisco • Tampa

Stauffer Chemical Company is a major source of acids, alums, bauxite, boron and boron products, caustic soda, chlorinated solvents, sulfurs, metallo-organics, and other basic chemicals.

DEFENSE CHEMISTRY

By WILLIAM T. READ, SR.

THIS SECTION is based on material from the Office of Technical Services of the Department of Commerce, a limited number of press releases from other sources, reprints from various Defense agencies, and to a very considerable extent on short articles published in *Chemical Engineering, Chemical Week, Chemical and Engineering News,* and *Industrial and Engineering Chemistry.* Grateful acknowledgements are made to all these sources. W. T. R.

INFORMATION AND MANAGEMENT

Data processing business machines may ultimately function in the writing of abstracts. A great deal of research yet remains to be done, but a lengthy article was recently processed on the basis of the number of times that words appeared and the proximity of important and much-used words to one another. The result was a 35 word sentence that was regarded as best illustrating what was said by the author. The machine is programmed to pick out the most mentioned words in a paper, to find the sentences where they appear most often and in close proximity, and to extract those sentences. The operation is more complicated than this, requiring the use of punched cards, deletion of common words, the use of a predetermined factor of proximity, and printing of sentences of high significance on an output tape.

The Science Information Service, established within the National Science Foundation, is charged with taking the lead in coordinating all science information activities in the United States Government; stimulating and coordinating activities in the science information field on a nation-wide basis; and making as full use as possible of existing information services, public and private, rather than supplanting or replacing present machinery. A 15-member Science Information Council has been appointed to advise the head of the new unit. In addition to several ex-officio members from Government, six members will represent basic science, six scientific documentation, and three the general public. The Science Information Service will emphasize small working conferences on specific problems, assist private organizations in publication of fundamental journals, and make grants for research in modern methods in the field of scientific information.

Beginning with 1959 a new science advisory group has been set up under the name of the Federal Council for Science and Technology. Heading this group and reporting directly to President Eisenhower is his Science Adviser, Dr. James R. Killian, Jr. Three members are directly named and include the Director of the National Science Foundation, the Director of Research and Engineering of the Department of Defense, and the Administrator of the National Aeronautics and Space Administration. A Commissioner of the Atomic Energy Commission is also included. The other agencies that are authorized to appoint a high-level science administrator from each organization are the Departments of Health, Education, and Welfare; Agriculture; Commerce; and Interior. The Science Adviser of the Department of State and a representative of the Budget Bureau are designated as observers. The Council is concerned with the science programs of all agencies in promoting cooperation and eliminating duplication; capital and manpower requirements; and the level and type of research financed by private sources, so that public and private efforts complement each other.

INSTRUMENTATION

In the field of instrumentation, five devices have been recently reported by the Army, Navy, and Air Force. These are as follows: 1) A fast neutron spectrometer embodying the principle of collimation of recoils with many times the efficency of a thin-radiator counter telescope. 2) an electron beam density probe for measurements in rarefied gas flows in low-density wind tunnels. 3) A portable adiabatic calorimeter to determine the free water content in snow and the heat of fusion of glacier ice. 4) A simple electrometer employing an electrified, nonconducting fiber in studies of atmospheric electricity by aircraft. 5) A pulse simulator for the study of flash burns, resembling the pulse of thermal radiation from atomic or thermonuclear explosions.

Vanadium determinations in Navy special fuel oil by conventional methods require from 16 to 24 hours for completion. By employing X-ray fluorescent techniques, the quantity present can be determined accurately in 15 minutes. The method involves a gas flow proportional counter and a pulse-height discriminator. By modifications of the equipment, other metals such as iron, nickel, and chromium may be determined in the same sample.

Barium titanate is the most commonly used ferroelectric in electronic equipment, but other ferroelectric materials afford considerable promise, based on a new technique for determining visually which parts of the crystals are positively or negatively charged. Heretofore this has been a tedious task, but assessment of polarity changes and checks of crystal uniformity can now be made by the application to the crystal of colloidal suspensions of electrically charged powders in an insulating organic liquid. When this suspension is applied to the face of a crystal, the particles are attracted

to those portions of the crystal that have an opposite charge. For example, sulfur and red lead (Pb_3O_4) in hexane are quite effective, the sulfur going to negatively charged portions of the surface and lead oxide to those bearing a positive charge. An organic compound, triglycine sulfate, and more complex derivatives of gadolinium and gallium show promise as ferroelectrics, and also may have uses in the "memory" elements of computers.

Solid state devices of the general nature of thermistors with positive temperature coefficients act as switches. This is accomplished by the thermistor becoming a high-resistance circuit element that opens the circuit. At a certain specified level, the rise in resistance is very abrupt. The level at which switching takes place is precontrolled by variation in the composition of the device as it is manufactured. An example given by the industrial manufacturer is that of one thermistor with a normal resistance at 100°F in boiling water, while another in a boiling solution of ammonium chloride at 112°F has a resistance some twenty times as great. Such devices are best adapted to preventing enclosed motors from becoming overheated.

PERSONNEL PROTECTION

Competent medical authorities are now convinced that dusts synergize pollution hazards, and that some gases escaping into the atmosphere become dangerous to human beings only when they are accompanied by finely divided solids. These solids may be entirely nontoxic, but when of fine-micron dimensions, they may contribute just as much to threatening the health of communities as small amounts of toxic gases. Water-soluble gases, which include most industrial contaminants of the atmosphere, are dissolved and removed in the upper respiratory tract and do not reach the lungs. Solid particles, however, that are less than 5 microns in diameter adsorb the toxic gases, and the combinations are deposited in the respiratory tract and the lungs as well. Such particles carrying toxic substances can interfere with breathing, throw an added burden on the heart, and poisonous materials may actually enter the blood stream.

With a relatively small increase in weight over previous types, the new protective poncho developed by the Quartermaster Corps of the Army functions both against weather and chemical-biological-radiological warfare agents. As a shadow-shielding device the body is protected against thermal radiations as high as 24 calories per square centimeter. The poncho is made from a saponified cellulose acetate coated with a neoprene composition.

DETERIORATION PREVENTION

Equipment dropped from planes which is not picked up immediately requires protective covering of fabrics. Being exposed to the attack of fungi, these fabrics must be impregnated with fungicides. The Air Force has recently carried out tests of several formulations, most of which are based on copper-8-quinolinolate, but one employs a compound derived from a fatty acid and phenol, known as dehydroabietyl ammonium pentachlorphenate. The last named had a somewhat lower breaking strength effect figure when fabrics containing it were tested, but the difference between all formulations was not over 10%. The covers of the aerial drop kits were made of a cotton sateen.

A disturbing lack of correlation between breaking strengths of fabrics exposed to severe deteriorating conditions and the quantity of the usually effective fungicide, copper-8-quinolinolate has been found by the Quartermaster Corps to be due to uneven deposition of the fungicide on the fibers. This could not be detected by the usual method of analysis requiring several feet of thread, but a semimicro-quantitative method involving spectrophotometry was worked out which required not more than one inch of thread weighing 3 or 4 milligrams.

NUCLEAR CHEMISTRY

Very few devices based on atomic energy have had such wide publicity in the current press as the five-pound "radio-isotope-fueled thermoelectric generator" which was announced by the White House after it had been inspected by President Eisenhower and officials of the Atomic Energy Commission. The generator produces electric power from heat, with polonium as a fuel, and a specially alloyed lead selenide as the thermoelectric material. The cost of the first generator was of the order of $15,000, but its manufacturers predict that its weight can be reduced to three pounds and its cost to $200 when mass produced. As yet it gives no promise of industrial applications, but in addition to employment in satellites, it could well be used in tracking hurricanes and in aids to sea and air navigation. In the first announcement, the statement was made that the new device could have kept President Eisenhower's voice broadcasting from the American Atlas satellite a full year rather than the 18 days. Polonium was readily available, but other radio-isotopes with longer half-lives may be employed.

Experiments at the Argonne National Laboratory indicate that the major factor in deaths that occur during the period not exceeding six days after whole-body irradiation are due to intestinal damage. Experiments on mice show the crypts, or regions which contain cells covering the villi in the small intestine, are destroyed. The villi are small projections that function in intestinal metabolism. When intestinal sensitivity is the test of effectiveness, fission neutrons are six or seven times as deadly as either X-rays or gamma rays. Low radiation doses do much less damage and are temporary, but if repeated daily for long periods, there are serious effects, although being short of destruction of crypts.

FOODS

Measurement of radioactivity in irradiated meat is being employed by an Army contractor to determine better methods of preservation of this food in storage. The assay will determine the residual cathepsin activity in the meat. Cathepsins are proteolytic enzymes, and are the cause of spoilage of stored meats.

Paramagnetic resonance studies of irradiation damage in crystalline carbohydrates indicate that answers may be obtained by this method as to what radicals are formed in foods subjected to irradiation preservation methods. The work so far has dealt with several related sugars, and further studies appear to be justified. The research has been jointly supported by the Air Force (OSR) and the Quartermaster Corps of the Army.

Combined efforts of chemists and plant geneticists have resulted in a starch of 55% amylose content that would appear to have particular application in the food

H. A. KUHN
Consultant
Chemical & Industrial
Reports • Surveys
1426 G Street N.W.
Washington 5, D. C.

industry in making rigid gels and soluble wrappers for frozen foods, meats, etc. The new type of starch may also find its way into textiles, paper, adhesives, and packaging materials. Some corn has been grown with still higher amylose content, but not in great quantities. By use of polar solvents or of inorganic salts, amylose can be selectively separated from the other components of starch, but not on a commercial scale. A particularly useful property of the new starch is that packaged foods wrapped in films made from it may be cooked without removal of wrappings.

CHEMICAL ENGINEERING

Air cooling instead of the time-honored use of water for this purpose is being strongly advocated by chemical engineers, although it is recognized that for condensing low-boiling organic liquids, water still has decided advantages. The first considerations in favor of the shift to air as a cooling medium are the dwindling supplies and mounting costs of water in many localities. About one fourth of all water used by manufacturing industries is required by chemical industries, and four fifths of this water is designated for cooling purposes. Present costs of equipment are somewhat less for air in some instances, but operating costs show decided savings. It will be necessary for the chemical industry to develop new designs in air-cooling equipment that are specially adapted to the peculiar needs of this industry.

Wetted wall trays represent a new tool in the unit chemical engineering operation of distillation. The new tray is characterized by numerous perforations, each of which have short downcomers. The liquid passing through the column wets the walls of these downcomers in addition to wetting the tray itself. Tests have indicated as much as 65% greater efficiency of the new equipment in comparison with the usual type of tray, and the pressure drop was reduced more than one half. Wetted wall trays can be used where packed towers are not suitable. The gas stream does not blow through the liquid, as is the case with sieve plates, perforated plates, or even bubble caps. Downcomers are also staggered with the effect of deflecting the gas in a slightly downward direction and across the liquid surface before it enters the next tray's downcomer. Turbulence gives good mass transfer, and the new trays are specially suited to vacuum distillation in which liquid flow rates are usually quite low.

Low-temperature separation of gaseous mixtures has hitherto been largely confined on an industrial scale to helium recovery from natural gas and fractional distillation of liquid air. One large manufacturer of low-temperature distillation equipment now proposes to extend this technique to the extraction of materials from waste and by-product gas streams. Critical shortages of hydrogen make such processes attractive in the recovery of this gas by fractional separation of impurities which prevent recycling, particularly the building up of catalyst poisons. Catalytic reforming operations in petroleum refining produce large quantities of hydrogen, along with other gases that render the hydrogen useless without some such clean-up method. No chemicals are used in the process, the refrigerant being liquid nitrogen. Combination of liquid air distillation plants with hydrogen recovery is illustrated by a steel plant making oxygen. Addition of equipment for recovery of hydrogen from coke-oven gas would make possible its use in up-grading by-product coke chemicals. In the same way a petroleum refinery cleaning up by-product gas streams could use oxygen for air enrichment of catalytic cracking regenerators, and nitrogen for blanketing instead of natural gas.

Desalting of saline water by freezing is to be tested in 1959 in a pilot plant with a capacity of 15,000 gallons of water per day, and the process is expected to become competitive with distillation and electrodialysis methods. A great amount of laboratory research on freezing techniques is being carried on in this country and abroad, but this is the first pilot-plant operation in the field. Advantages claimed for the method include lessened corrosion because of low temperatures, and the fact that the heat of fusion is only about one seventh that of vaporization. The new plant, when completed, will freeze water directly rather than by the use of refrigerants, the feed of saline water being introduced into a high-vacuum chamber. Evaporation of around 15% of the water will result in a slush of fairly pure ice crystals, which will be washed countercurrent with water in a separator column. The product will then be melted by water vapor from the freezing column, which condenses on the ice crystals. Other investigators are working on a laboratory scale in methods involving immiscible refrigerants, increasing size of crystals, and washing them with nonaqueous solvents, and by the application of some freezing techniques.

METALS

While it will probably be many years before the iron blast furnace is replaced to any extent by equipment in which iron is reduced by hydrogen, the possibilities of such developments are being examined by mechanical engineers. Such advancements would lead to a decentralization of the iron and steel industry. The capital cost of the modern blast furnace has greatly increased, while there have been many forward steps in the natural gas and petroleum industries. Hydrogen reduction appears to be particularly adapted to regions where natural gas and petroleum are abundant, and where producers are looking for outlets. Coke is not available without high transportation costs in many parts of the country. Production of iron by hydrogen reduction would require about 10% of the present consumption of natural gas.

A contractor for the Navy's Bureau of Aeronautics has developed new iron-aluminum-manganese alloys which may replace more expensive alloys which are heavier and made from more expensive metals. One alloy contains somewhat more than half of its weight of iron, about one third of manganese, one tenth of aluminum, and less than 1% carbon. This family of alloys has an austenitic structure, and its members are around 15% lighter than carbon or 18-8 stainless steel, and still lighter than nickel and cobalt-base alloys. The particular alloy described above has high strength at temperatures above 1200°F, and is ductile at room temperature.

Aluminum silicone paints have been replaced for the protection of titanium during heat treatment by a ceramic coating, the process having been developed by a leading airplane manufacturer. The coating, which may be sprayed, is fast-drying. It is made up of a soda-boroaluminate glass, a binding agent, a suspending agent, and a vehicle, the binder being a formaldehyde resin, and the vehicle, alcohol. Three spray coats are applied within one hour's time, and the titanium sheets go to the furnace. Scratches before heat treatment are mended by respraying. The final coat has the appearance of white paint, and when the organic material burns out, the coating looks like glass. Removal of the

(Continued on page 24)

Specialist!

This handsome fellow specializes in "inside jobs." He's the corn borer. He may not be the ugliest insect known to Agriculture, but the damage he inflicts ranks him right up there with the worst.

One fact remains very clear. The corn borer and his flying, crawling, burrowing and hopping "cousins" still get too large a share of Agricultural production.

Only through continuing research and experimentation can we hope to win the vigorous battle with the insect world. Shell Chemical Corporation, with the valuable co-operation of independent entomologists, U.S.D.A. staff researchers, extension workers and growers, strives to develop better and more successful pesticides to reduce crop losses.

Modern Shell pesticides, now in use as a result of this close co-operation, include aldrin, dieldrin, endrin, Methyl Parathion and Phosdrin® insecticides; D-D® and Nemagon® Soil Fumigants and Allyl Alcohol weed seed killer.

Newer pesticides, now in the laboratory stages at Shell Chemical's experimental research center at Modesto, California, promise an even more effective defense against insects.

Shell Chemical Corporation looks to a better tomorrow for Agriculture through chemical research today. For technical information on Shell products, write to:

SHELL

SHELL CHEMICAL CORPORATION

AGRICULTURAL CHEMICALS DIVISION
460 PARK AVENUE, NEW YORK 22, NEW YORK

DEFENSE CHEMISTRY

(Continued from page 22)

glass is easily and quickly accomplished by a caustic solution.

A silver anode characterizes a solid electrolyte battery system developed for the Signal Corps, which appears to be suited to commercial production. Such batteries are small in size, have long shelf-life, and are of a novel cup shape. The electrolyte is silver chloride, and the cathode consists of chlorine and iodine monochloride liberated from potassium tetrachloriodide.

A new process for producing metals of extreme purity by the formation of a volatile iodide has just been announced. Initial production will be chromium with less than 10 ppm of oxygen and 5 ppm of nitrogen. Decomposition of the iodide returns iodine to the process with deposition of the purified metal. The new process is said not to require resistance-wire filaments; equipment is simple and requires little attention in its operation; and iodine losses are negligible. Iodide chromium will probably find considerable use in alloys for high temperature in gas turbines and nuclear reactors.

A brazed honeycomb sandwich has been developed for the Air Force to withstand temperatures up to 1200°F. Honeycomb cores are made from corrosion-resistant steel alloys, brazed with alloys containing silver, manganese, and aluminum, modified by lithium. The sandwich has good structural and fatigue properties at the higher temperatures.

Foamed metals based on nickel, copper, and cast iron are now in the development stage, and give promise of extensive applications in jet engines as seals, filters, insulators, and coolers. A further use in the electrical field is based on the increased capacity of foamed metal to carry current with greatly lessened heat effects. Samples are reported as weighing about one ninth as much as the solid metal, having a density the same as that of water.

Ultrafine powdered aluminum is being produced in small quantities for experimental study in a number of fields, and the process is said to be applicable to a number of other metals. The particles are spherical as shown by the electron microscope and are pyrophoric, being stored and handled under unreactive hydrocarbons. The usual aluminum powder particles are around 5 to 10 microns in diameter, but the upper limit of the new type of material is 0.1 micron, an average particle size is 0.03 microns, and some are as low as 50 angstrom units. The increase in surface energy is tremendous, since the surface area of one gram is around 750,000 sq. cm. The first application is likely to be in catalytic chemical processes, and in the making of organometallics, but powder metallurgy may be ultimately a major outlet.

The Navy's Bureau of Aeronautics, according to a recent report, is having built a facility for processing high-temperature refractory and reactive metals into billets, bars, sheets, and forgings at around 4000°F in an atmosphere of argon. Such metals include niobium, tantalum, and molybdenum, which will be handled in this prototype plant. All technicians and operators within the plant, which is 40 by 80 by 22 feet, will wear "space suits" into which conditioned air will be fed through one hose, and from which exhaled air containing carbon dioxide will be removed by another hose. The argon of 99.9995% purity will be thus protected against contamination. When the parts are finished, they will be coated to prevent nitridation and oxidation when they are later exposed to the air. The new facility, due for completion by the end of 1959, will show how missile nose cones, rockets, and jet engines, and, in course of time, space vehicles are to be formed. The plant is equipped with supplies of conditioned air, man and equipment locks, safety controls, and an argon-purification system.

A promising development in the field of welding dissimilar metals is based on ultrasonics, and work is continuing on increasing the speed of welding and the thickness of metals to be welded. The general principle is the use of two wheels that are vibrating at 20 kilocycles per second. The peripheries of the wheels make contact with the metals on opposite sides of the sheets, break up the oxide coating, and by a kneading action weld the metal lattices on the surface. A variable speed drive moves the wheels through the equipment. Welds are quite similar in appearance to electric welds. Some examples of the ultrasonic procedure are the seam welding of two aluminum sheets of 0.010 inch thickness, and at a rate of 15 inches per minute, and the seam welding of light silver foil to copper strap at a somewhat higher speed. Dissimilar metals can be welded by this method which can not be handled by fusion methods, and large deformations are not required as in the case of cold welding. No surface preparation is required prior to welding.

HEAVY CHEMICALS—INORGANIC

Although more powerful liquid oxidizers, liquid monopropellants, and solid propellants are strong competitors of liquid oxygen in the field of missiles, there is a marked increase in the production of oxygen in industry, particularly with increased demand for high-purity oxygen. The steel industry consumes fully half of the nation's supply of oxygen, not only in special blast furnaces and oxygen converters, but in jet-piercing taconite ores, speeding up refining in open hearth and electric furnaces, and in removing imperfections from surfaces of billets, blooms, and slabs. The chemical industry uses about one fourth of the supply, with missiles taking around 20%. Welding and medical therapy account for a good part of the remaining 5%.

At one time used almost exclusively in etching glass, hydrofluoric acid has developed into one of the most versatile and useful of chemicals, less than 2% of it being employed in the glass industry. During World War II, it served to produce alkylate for high-octane aviation gasoline and to refine uranium for the atomic bomb. The two largest uses of hydrofluoric acid, accounting for considerably more than half of its annual output, are the manufacture of synthetic aluminum fluoride for the aluminum industry, and the production of fluoro-carbons as aerosol propellants and refrigerants. As fusion replaces fission in the atomic energy field, the requirements for hydrofluoric acid will likely drop. The replacement of present aircraft engines by kersosene-burning jets will also decrease its use in making aircraft fuel, but internal combustion engines will continue to require high-octane fuel. There is considerable speculation among manufacturers of hydrofluoric acid as to the possibilities of the use of elemental fluorine, which is made from this acid, as an oxidizer in rockets and space vehicles.

Since the product of ammonia oxidation and nitric oxide absorption is a nitric acid with as high as 40% water, the conversion of this acid to a concentration of 99% or more requires sulfuric acid and expensive concentration of this acid for reuse. A recently announced process uses magnesium nitrate as a dehydrating agent, this being made by the action of the first

product acid on magnesium carbonate. The solution of the nitrate is evaporated and the salt is fed to the dehydrating tower. Tray columns replace the packed columns of the old process. Once charged, only the losses of the dehydrating salt need to be made up by fresh carbonate. The entire system of sulfuric acid reconcentration is eliminated.

ORGANIC CHEMICALS

Diborane is known as an expensive rocket fuel, but recent research has shown it to be the key to a new addition reaction for olefins, by means of which a variety of alcohols may be made. One pound of diborane can produce around 30 pounds of a C_{10} alcohol. The research is still of theoretical interest because of the expense of the reagent, but may prove of considerable value in organic research leading to fine chemicals. It is not necessary to handle diborane, but instead sodium borohydride is reacted with boron trifluoride, and the resulting diborane reacts instantly with a variety of olefins. An interesting phase of the reaction is that *cis* addition always takes place regardless of the number of the hydrogen atoms attached to a carbon atom. The addition reaction is carried out in ether, and hydrogen peroxide causes the formation of a primary alcohol even when the double bond is not at the end of a chain. The boron atom is regarded as "walking down" to the end of the chain of carbon atoms.

The production in great quantities of aromatic hydrocarbons of high purity from low-molecular-weight petroleum products has overshadowed to a considerable extent the original sources of these materials from coke-oven light oils. Since coal carbonization accompanies steel production, the by-products of this operation are in demand by the chemical industry, particularly if they can be furnished in a high degree of purity. This is now being accomplished in a large plant of a steel company, light oils from three steel-mill coke ovens being brought to the new chemical-aromatics unit. A leaf has been taken from the petroleum industry's book in several of the procedures designed to turn out a product competitive with petrochemical materials. The light oils from the coke ovens are stripped of carbon disulfide, and light ends are then sent to a Hydrorefining operation in which selective hydrogenation takes care of unsaturates and sulfur compounds without changing benzene, toluene, and the xylenes. After caustic treatment and scrubbing, the products are extracted with aqueous diethylene glycol to remove the pure aromatics from paraffins. After recovery of the extracting solvent and final fractionation and clay treatment, the aromatics meet very exacting specifications.

HIGH POLYMERS—PLASTICS

A new thermoplastic produced from pentaerythrytol and classed as a chlorinated polyether has about completed the pilot-plant stages of development, and is to be made in the near future on a commercial scale. Pentaerythrytol is reacted with hydrogen chloride, and the product is made to undergo ring closure with loss of water to form a cyclic ether, which is polymerized. The new material is easily fabricated, is highly resistant chemically, and has attractive mechanical, electrical, and chemical properties. Its first outlet, based on the experience of a number of potential consumers, will be anticorrosion equipment, such as valves, fittings, and coatings. It will thus take a place in the plastics field along with nylon, fluorocarbons, polyacetals, and some alloys and metals.

The Nation's Top **100**
Industrial Corporations All Use Harshaw Chemicals

For each of 50 different industries, including the Nation's top 100 industrial corporations, Harshaw produces a variety of important chemicals. For instance, the Petroleum Industry regularly purchases catalysts, metallic soaps, salts and crystals. The Automobile Industry buys electroplating chemicals and anodes, catalysts, fluorides, pigments and metallic soaps. The Chemical Industry uses products from six of our ten industrial divisions.

Harshaw produces over 1000 different chemicals for more than 15,000 customers throughout the World. *Probably we have a chemical you can use.* If you have something specific in mind ask us. At your request we'll forward a catalog listing our major products and describing our company.

THE HARSHAW CHEMICAL CO.
1945 EAST 97th STREET • CLEVELAND 6, OHIO
CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES
HASTINGS-ON-HUDSON • PHILADELPHIA • PITTSBURGH

HARSHAW

Polycarbonate resins were announced in 1957, but are now being produced in this country on a pilot-plant scale, and several hundred pounds have been tested by commercial molders, and 25 pound quantities are being sold for market development work. Polycarbonate resins result from the condensation of diphenols and acid chlorides, and the fundamental unit is made up of two benzene rings joined by a carbon with two methyl groups. In the para position on each end of the two rings there is an oxygen atom, one of which is attached to a carbonyl group. These resins are exceptionally tough, and are said to have higher impact and tensile strengths than any other commercial plastic. They have good mechanical and electrical properties, and their heat resistance is second only to the phenolics. The polycarbonates are expected to be used in electrical and electronic equipment exposed to heat and hard usage, and may even replace metals in molded units.

Oriented prestretching of Mylar polyester film base has resulted in high-strength and very thin magnetic sound-recording tape, the concentration in strength being in a lengthwise direction. The demand for such tape is based on space requirements of small reels.

A fabric of Teflon and cotton impregnated with a phenolic resin is the basis of bearings that require no lubrication and have a record of long wear. The shaped material is bonded to a metal receptacle by a heat-sensitive resin, and pressures of several tons per square inch are applied at 340°F. The product has a low coefficient of friction, and resists the action of acids, alkalies, electrolysis, and sea water. The special applications of these bearings appear to be in the field of motor vehicles, but have uses in industrial machinery, materials-handling equipment, and also in marine and aircraft production.

The most widely used and best known form of nylon is Type 66, made from two raw materials, each of which has six carbon atoms. Type 6 nylon, polymerized from caprolactam, in which there is a single six-carbon ring, has been manufactured abroad for several years, but only within the past three years has been made in quantity in this country. A new plant capable of producing 50 million pounds per year is to be built in 1959. This has focused the attention of plastic users on this type of nylon, particularly since it has some characteristics not possessed by the older variety. In the fiber field, growth in its use has been rapid, although it represents only a small fraction of the use of the older material. As a plastic, and particularly in chemical process applications, the Type 6 material is light in weight, has higher impact strength, and is self-lubricating, and it has good chemical resistance to alkalies and many solvents. It may be heat-stabilized to function through a range of −40°F to +300°F. It also has such varied uses as gears, valves, belting, and piping.

The Navy has found that ropes of stabilized, pigmented, high-molecular weight polyethylene have outstanding resistance to weather as well as undergoing no permanent plastic flow under the application of normal loads. In comparison, clear, unstabilized polyethylene ropes that had been exposed to sunlight for a year lost 90% of strength.

The response to compression of typical linear polymers, of which polystyrene and polyethylene are representative, has been the subject of intensive research by the U. S. Army Signal Corps. The effects of bulk compressibility of plastic melts are important both on commercial fabrication conditions and the properties of finished products. In some cases the effects of pressure on highly compressible melts are structural changes. In the case of polystyrene, subjection of the melt to pressure and subsequent cooling resulted in a material that was more dense, rigid, and crystalline than the original injection-molded specimen.

Further pilot-plant development of the perarylated silanes, reported under the heading of Basic Research in an earlier issue of the JOURNAL, has confirmed the prediction of the high thermal stability of these compounds, which should make them very valuable in the plastics, electrical, and coating industries. Sufficient information has been gathered from pilot-plant operations to give the optimum conditions of reaction and the engineering data for a production plant. Seven different derivatives, all containing phenyl groups and of different degrees of complexity as compared with the tetraphenyl silane originally reported, have been made by the Air Force on a pilot-plant scale.

HIGH POLYMERS—RUBBER

A conference on Elastomers, sponsored jointly by the Army, Navy, and Air Force was held on October 15-17 at Dayton, Ohio. Papers were mainly of the progress-report type, and covered such topics as fluorocarbons, siloxanes, and organometallics; collapsible tubes capable of transporting 40 tons of kerosene by towing; compatability of elastomers and rocket propellants; resistance of polymers to hydrogen peroxide; curing of compounds by gamma radiation; the effect of elastomers on the reactivity of explosives with which they were in contact; the influence of accelerator residues on age resistance; vinyllic fillers with carboxylic groups on the particle surface; and measurement of properties of elastomers at higher temperatures with low elongations.

As a part of researches in the behavior of rubber, such as giving up and taking up heat during deformation and its infrared absorption and crystallization, a *cis*, 1-4-polyisoprene, which is the main component of natural rubber, has been prepared in which each hydrogen atom has been replaced by a deuterium atom. The resulting material is more elastic than natural rubber, possibly because deuterium atoms have less attraction for each other. It does not require carbon black to give it high tensile strength. The work at present is purely of theoretical interest.

Work on the relation between the swelling of acrylonitrile-butadiene rubbers and their physical properties, as carried out by the Quartermaster Corps, has led to a general equation. By utilizing two specific constants for each type of rubber, which can be employed in the general equation originally developed, losses in physical properties can be predicted from simple volume swell measurements in samples cut from each item.

Tin has certain resemblances to carbon and silicon in its chemical reactions, and this has led to the exploration of possibilities of making organic derivatives of tin which might be polymerized to give elastomers having thermal stability and chemical resistivity. In the preliminary investigations of the Quartermaster Corps, some very promising results have been obtained by the combination of tributyltin oxide or diacetate with dicarboxylic acids. Polymers of tributyltin acrylate esters have been formed, both of cyclic and chain types, and some of these have rubbery and elastomeric properties, which may lead to products that could take their place along with organosilicon derivatives.

FUELS—CONVENTIONAL

Bacteria of a certain type have the astonishing property of thriving and finding nutrient material in kerosene-type jet aircraft fuel. These bacteria form a sludge

which seriously interferes with the operation of filter systems and in refueling equipment. The action of these microorganisms includes emulsification of the liquid with formation of gummy residues, and the bacteria themselves compose precipitates. The remedy has been found in dilute solutions of sodium and potassium tetraborates in the water bottoms of storage tanks containing the aircraft fuel, this work having been carried out by the Air Force.

The Atomic Energy Commission and the United States Bureau of Mines have jointly outlined to some 125 representatives of industry a plan for a nuclear explosion to break up oil shale for recovery of oil. This is a part of the AEC's Plowshare program for peaceful uses of nuclear explosions. In 1957 the first completely contained nuclear explosion proved that such shots can be made without incurring either seismic or radioactive hazards. There is, however, a difference between the stratified loose rock of this explosion and shale formations. The principal effect would be to break up the shale so that it could be processed for oil, but it is possible that the heat of the explosion might drive out some oil which could be recovered. The test blast is to be in the 10-kiloton range, and should shatter around 300,000 tons of shale. With a 300-kiloton blast, crushing costs should be of the order of 3 cents per ton, the amount shattered running to around 35 million tons. The yield from the smaller shot is estimated at 10 million cubic feet of gas and 15,000 barrels of oil, but little is known of the effects of high pressures and temperatures on the results. The government-owned shale oil plant at Rifle, Colorado has been idle for several years, but the proposal to sell it for surplus has been dropped for the present at least.

In the earlier years of hydrocarbon recovery from natural gas, adsorption by charcoal was extensively employed, but was later discarded in favor of oil absorption and refrigeration. New adsorption units employing granular adsorbents, operatitng on short process cycles, and with smaller equipment, are entering the field. They are expected to take care to an increasing extent of gas streams amounting to 10,000 million cu.ft. per day, which were either too small or too lean to be handled by present equipment. Both fixed and moving beds of adsorbent are being used, and all are regenerated by burning natural gas instead of using high-pressure steam, as was the case with the old charcoal plants. One plant recovers only pentanes and higher hydrocarbons, while the others can recover liquefied petroleum gas.

FUELS—ROCKETS AND SPACE VEHICLES

What now would appear to be in the realm of pure theory and speculation may turn out to be new high-impulse fuels for satellites and space vehicles. Scientists from the Army Ballistic Agency (Redstone Arsenal) have told an American Chemical Society regional meeting that temperatures below 100°K may result in chemical propellant systems of high energy. In addition to free radicals and high energy molecules, of which the nitrogen fluorides are typical, a form of metastable helium in what is known as the 2^3s state has theoretical specific impulse of 2900 seconds at 40 atmospheres pressure. This material may exist as a solid at 4.2°K, or may be combined with hydrogen as helium hydride with only slightly lower specific impulse. This metastable helium would thus have about ten times the power of present high energy fuels.

A new apparatus, developed at the National Bureau of Standards, has succeeded in separating monatomic hydrogen atoms and appreciably delaying their recombination. This is accomplished by passing atoms from a microwave discharge source through a slit into a large chamber under very low pressure (10^{-4} mm of mercury), and, without permitting collisions and recombination, splitting the beam into two components with different electron spin states. The beams impinge on a metal surface at 1°K so that recombination does not take place immediately. The presence of the atoms is determined by measuring heat of final recombination. This is a very long way from utilization of monatomic hydrogen as a rocket fuel with its energy of thirteen to seventeen times that of present fuels, but the research constitutes a beginning of a possible solution of the problem.

Tonnage quantities of boron-based jet fuel are expected from additional process units in a new $38 million plant of the Navy, these units being now under construction. Basic raw materials for the process are boric acid, sodium, methanol, ethanol, and methane. Methyl borate is made from methanol and boric acid, which is purified by an elaborate distillation process. Sodium hydride is made from the metal and hydrogen. From these two intermediates, diborane is made, which is alkylated with ethylene and polymerized to yield jet fuel. Methane is reformed to make hydrogen for the process, and is also burned with air to yield nitrogen as a blanketing agent. Ethanol is cracked to make the required ethylene. A very large steam plant using natural gas is required for the installation, because of the energy necessary to make the fuel.

A variety of chemicals are now being tested for use in rocket propellants. In the field of liquid propellants, developments include the following. Nitrogen tetroxide, N_2O_4, with hydrazine equals the performance of liquid oxygen with kerosene-type fuels, and is superior in storability and ease of handling, in spite of a narrow liquid range. Fluorine, with all its handling difficulties, is said to be close to operational use, having been test-fired in 1958. The results have justified larger volume production of this element, and scale-up of rockets adapted to its use, with a promise of 20% increase in rocket performance. In the field of solid propellants, attention is centered on unusual fluorine-containing solids as additives; aluminum and magnesium in ammonium perchlorate-rubber-fuel binders; substitution of lithium perchlorate for the ammonium salt because of greater oxygen content; ozonide; organic nitrogen compounds such as polynitro esters and alcohols; and improved polymeric fuels with better properties and greater stability. In the more distant future are atomic rocket power plants with a nuclear pile and hydrogen and helium, as well as free radicals and ion propulsion systems.

DR. SCHLESINGER HONORED BY NAVY FOR BORON CHEMISTRY

Dr. Hermann I. Schlesinger, Professor Emeritus, University of Chicago, was awarded the Navy Distinguished Public Service Award for his outstanding contributions to the Department of the Navy in the field of chemical sciences, at ceremonies on February 11. Rear Admiral Rawson Bennett, USN, Chief of Naval Research, made the presentation of the award—the highest given to a person not employed by the Department of the Navy.

Dr. Schlesinger introduced boron chemistry in this country nearly thirty years ago. His research in boron hydrides served as a foundation for the Navy's high energy fuels, or "ZIP" program.

FOLLOW-UP OF R.O.T.C.

(Continued from page 18)

1954

JAMES H. FUTRELL

Air Force—Louisiana Polytechnic Institute, Ruston, La.

Mr. Futrell is one of those winners who have gone on for advanced degrees. He received his BS in Chemical Engineering Summa Cum Laude, in 1955; obtained a National Science Foundation Predoctoral Fellowship at the University of California, at Berkeley, California; while engaged there as a teacher and research assistant, he was awarded the Allied Chemical and Dye Corporation Fellowship in Physical Chemistry and has engaged in work at the University of California Radiation Laboratory. He received his degree of Doctor of Philosophy in Chemistry in 1958, his thesis being entitled "The Radiation Chemistry of the Symmetrical Diochloroethylenes."

In September 1958, Mr. Futrell writes Mr. Johnson, he joined Humble Oil & Refining Company, Baytown, Texas Research and Development Division, as Research Chemist studying radiation chemistry of hydrocarbons.

ALVIN J. MAJOR, JR.

Army—University of Delaware, Newark, Delaware

In response to a letter from Colonel Daniel N. Sundt, PMS&T, at the University, Mr. Major stated in part:

"Since leaving the University of Delaware I have attended the Massachusetts Institute of Technology, obtaining the degree of SM in chemical engineering; served six months active duty; and worked as an engineer for the Du Pont Company.

"I am presently working at the Du Pont Company's Chambers Works, located at Pennsgrove, New Jersey, as a chemical engineer.

"My active duty assignment extended from 10 April 1956 through 9 October 1956. This time was evenly distributed between the Engineer Officers Basic Course and an assignment to the Training Division of the Engineer School, Fort Belvoir, Virginia."

CHESTER J. PETKIEWICZ

Air Force—Lowell Technological Institute, Lowell, Mass.

Mr. Petkiewicz, who received his award two years before his graduation in 1956, writes:

". . . After graduation, I joined the Research and Development staff of the American Viscose Corporation, located in Marcus Hook, Pennsylvania. My duties consisted of research and development work on existing products, with a view toward modification and improvement . . . Research was also directed at new products for consumer markets, being specifically applied toward product diversification.

"After five months, in November 1956, I was called to active duty with the U.S. Air Force. . . .

"My date of separation from the service is November 1959, and my present plans call for return to the R&D Division of the American Viscose Corporation."

JERRY E. WEIMANN

Army—University of Illinois, Champlain, Illinois

Mr. Weimann in outlining his activities since graduation in 1955, states that, following graduation, he entered on active duty and during 1955 he served at Aberdeen Proving Ground, Maryland, as Vehicle Maintenance Officer; in 1956 at Sioux Ordnance Depot, Sidney, Nebraska, as Ammunition Maintenance Officer; and in 1957, at Fort Hood, Texas, as Maintenance and Repair Officer.

After his active military duty, in 1958, he joined Armour Laboratories, Kankakee, Illinois, as a pharmaceutical salesman, and in December of that year he joined Warren-Teed Products Co., Columbus, Ohio, in that capacity.

1955

LT. (jg) W. S. CHILTON

Navy—Duke University, Raleigh, North Carolina

Lt. Chilton, now in the Naval service, plans to continue his studies as a candidate for a Doctorate in Chemistry. He writes:

"I am presently Combat Information Center Officer on a destroyer in the Mediterranean. On graduation from Duke University, I accepted a Fulbright Scholarship to the University of Tuebingen, Germany, where I spent one year studying organic chemistry and doing research under Prof. Dr. H. Hellmann. I was commissioned Ensign in the U.S. Navy on my return to the United States in August 1956 and ordered to duty aboard the Destroyer Waldron. I will be released from active duty in August 1959 and plan to enter graduate school that fall as a candidate for the Doctor of Philosophy degree in chemistry."

Lt. Chilton received the A.F.C.A. award also in 1954.

LT. JAMES C. MELVILLE

Army—State College of Washington, Pullman, Washington

Lt. Melville, who received his award in 1955, is now on duty as a 1st Lieutenant. He writes:

"After I received my B.S. from Washington State in 1956, I took a position at Convair Aircraft Co. as a thermodynamics engineer. In this position I was primarily concerned with aero-thermochemical problems encountered by high performance missiles.

"In October 1956, I received my active duty assignment to Wright-Patterson Air Force Base at Dayton, Ohio. I am now assigned to the Fuel and Oil Branch of the Propulsion Laboratory as the cognizant engineer of a project under which rocket fuels are synthesized and improved."

RICHARD E. RUSSELL

Navy—Georgia Institute of Technology, Atlanta, Georgia

Mr. Russell, now employed as a chemical engineer, served in the Navy. He summarized his post-graduation activities as follows:

"(a) Four weeks employment with the Humble Oil & Refinining Co., Baytown, Texas, from June to July 1955. (b) Tour of duty aboard the USS MAUNA LOA (AE-8) from July 1955 to December 1956. Primary billet was Damage Control Assistant, with rank of Ensign, USNR. Included was a ten-week course at Damage Control and Atomic, Biological and Chemical Defense School at Philadelphia. (c) Tour of duty from December 1956 to July 1957 as Engineer Officer (as Lt. jg) aboard the USS VIGIL (YAGR-12). (d) Reemployed August 1957 by the Humble Oil and Refining Co's Baytown Refinery, as a Junior Chemical Engineer in the Technical Division. Am also a member of Naval Reserve Research Co. 8-4 in Houston, Texas."

Mr. Russell received the A.F.C.A. Award also in 1954.

JAMES K. WILLIAMS

Air Force—Georgia Institute of Technology, Atlanta, Georgia

Mr. Williams, who received his award in 1955, is now on duty at Otis Air Force Base, Massachusetts. He outlines his post-graduation activities as follows:

"Immediately after graduating in June 1956, I went to work for Continental Oil Company as Process Engineer. I worked for the company in Ponca City, Oklahoma, for approximately one year before taking a leave of absence to enter on a three year tour of active duty in the Air Force.

"After entering the Air Force in June 1957, I underwent primary pilot training at Bartow Air Base,

Florida, for six months. At the end of that time I elected to withdraw from the program rather than extend my tour of duty to five years in order to complete flying training. For the past ten months I have been performing duty at Otis Air Force Base, Massachusetts, as an Administrative Officer in the 551st Electronics Maintenance Squadron."

1956

JOHN D. BALDESCHWIELER

Army—Cornell University, Ithaca, New York

Mr. Baldeschwieler, whose present address is 52 Panoramic Way, Berkeley 4, California, writes:

"In the summer of 1956 I worked for ESSO Research and Engineering Co., in Linden, N.J. I was responsible for developing radioactive wear testing procedures, general radiochemical measurements, and gamma spectroscopy.

"Since September 1956 I have been working on my doctorate at the University of California, Berkeley, in Physical Chemistry. My general area of interest is molecular spectroscopy, particularly vibrational spectra. I have been using low temperature, matrix isolation methods to study very unstable species. These include HN_3, NH, and NH_2 free radicals, and many unusual structural isomers of the oxides of nitrogen. My work at Berkeley has been sponsored for three years by the National Science Foundation Fellowship."

JOHN R. EAGLE

Army—University of Delaware, Newark, Delaware

Mr. Eagle, who has served in the Chemical Corps, writes:

"Upon graduating in June '56, I immediately went to work as a process design engineer for the ESSO Research and Engineering Co., Linden, New Jersey. In September of that year I began my two year tour of duty by reporting for the thirteen-week Chemical Officers Basic Course at Fort McClellan, Alabama. Upon completion of the course in December, I received orders to Muscle Shoals, Alabama.

"At Muscle Shoals I became part of the Chemical Corps personnel, working at the Phosphate Development Works . . . intermediate nerve gas production plant. This plant, . . . operated jointly with the Tennessee Valley Authority, offered me twenty months of fine opportunity to apply my engineering background. For over half of my tour I was appointed the post of Chief of the Engineering Division. . . . Toward the latter part of my stay . . . most of my work involved lay-away or moth-balling, rather than the usual production type work. Other assignments and/or positions I was given there included: Acting Inspector-General, Adjutant, Transportation Officer, Finance Officer, and USAFI Officer. . . .

"Since my discharge I have returned to my former company and I am presently living with my wife and daughter in Westfield, New Jersey. About the only comment I would like to make is that I do regret that I did not have an opportunity to serve any portion of my two years with a troop assignment. . . ."

Mr. Eagle received the A.F.C.A. Award also in 1955.

RUSSELL L. NIELSEN

Army—University of Nebraska, Lincoln, Nebraska

Mr. Nielsen, who graduated in Chemical Engineering in August, 1957, is now on duty at Fort McClellan, Alabama. He writes:

"After receiving the award, I received my B.S. in Chemical Engineering in August 1957. I remained at the University of Nebraska for another year and received my M.S. in June 1958. After graduation I worked for three months with the Mathematical Engineering Branch of the R&D Department of the Phillips Petroleum Company. I am currently enrolled in the Chemical Corps Officers Basic Class at Fort McClellan, Alabama. When my six months tour of duty ends in March, I will return to Phillips in Bartlesville, Oklahoma.

LT. DONALD WERSCHKY

Air Force—University of Colorado, Boulder, Colorado

Mr. Werschky, a Chemical Engineering and Business graduate, is now stationed at Yokota Air Base, Japan. He writes:

"I was fortunate to receive this award in 1956. After graduating in June 1956, I was employed as a chemical engineer by Union Carbide Chemicals Corporation, at their Whiting, Indiana, plant. In November of that year I was called to active duty in the Air Force. Since that time I have attended two Air Force Schools. . . . I am presently assigned at Yokota Air Base, Japan.

"My Air Force duty has never been directly concerned with the chemical sciences. Nevertheless, just as basic science is useful in any field, my training has been of great help in all my endeavors."

JOHN B. LUTZ

Navy—Columbia University, New York

"I was commissioned in the Navy as an Ensign on June 3, 1958. I reported to my present duty station, the USS FIRM, soon afterwards. The FIRM is a minesweeper that operates out of Long Beach, California. At present, we are stationed in the Western Pacific to support the Far East Fleet. Our cruise began November 3 and will extend for a seven month period. My present tour of duty is two years.

(Continued on page 31)

ARMED FORCES
TECHNICAL PERSONNEL

When you become available for civilian activity, be sure to check the excellent advancement opportunities in the aluminum industry. Write now to

General Employment Manager
Reynolds Metals Company
Richmond, Virginia

Sales Offices in all principal cities. Plants in 14 states and 13 foreign countries.

THE CHEMIST IN THE INTERNATIONAL GEOPHYSICAL YEAR

HUGH ODISHAW
Executive Director, USNC-IGY
National Academy of Sciences-National Research Council
Washington, D. C.

(Condensation of a paper presented at the annual meeting, April 11, 1958, at Los Angeles of the American Institute of Chemists, originally printed in the November 1958 issue of *The Chemist*, published by the AIC, and reprinted here by permission.)

DURING THE eighteen months of the International Geophysical Year (July 1957-December 1958) the earth, the oceans, the atmosphere, and the sun are being studied on the most comprehensive scale ever attempted. Some 10,000 scientists from 66 nations are formally participating at stations around the world and from pole to pole.

The primary objective of the IGY is the acquisition of synoptic data—based on simultaneous observations all over the earth. To understand better many of the features of our environment, particularly those events relating to the atmosphere, coordinated, worldwide studies are required.

New instruments, techniques and tools have been developed—including the first artificial satellites which permit scientists to send instruments directly into the upper atmosphere and beyond, to examine events there without the screening effects of the denser air.

Chemistry, though not a geophysical discipline, nevertheless plays a significant role in IGY studies. In oceanography, temperature and salinity measurements are made to determine the density of the water so that ocean currents can be computed, much as air currents are computed from barometric readings. Salinity of sea water samples has usually been determined by titrating against silver nitrate. Such methods have been slow and the precision has been dependent upon the operator. Over the years, refractive index, electrical conductivity, and automatic titration have all been tried. A new semi-automatic conductivity meter for shipboard and laboratory use has been made by Schleicher and Bradshaw of the Woods Hole Oceanographic Institute and has been used with remarkable success on several sea-going trips. A second, and perhaps improved, instrument is being made now, and there may be several more in another year.

Identification of water masses to determine the deep currents of the oceans is also accomplished by examination of the concentrations of dissolved oxygen, phosphates, nitrates, carbonates, and other chemical components; and ocean bottom sediments are dated by means of radioactive isotopes and are further studied to increase our understanding of the biochemical reactions involved in the deposition of sediments. Mass spectrographic methods are also used in the study of ocean sediments, and meteoric material is extracted from sediments by magnetic means.

In the IGY meteorological program, ozone, which may be responsible for the large annual variation in temperatures in the polar stratosphere, is being studied. Ozone concentration is being measured with the Dobson ozone spectrometer at 13 stations, 7 of which have been set up for the IGY. This instrument records ultraviolet light in several bands, including ozone absorption bands. Comparison of intensities in absorption and non-absorption regions allows calculation of the total amount of ozone present in the light path.

Surface ozone is being measured near both poles and near Mauna Loa by chemical methods. Ozone is brought near the earth's surface by downward diffusion from the ozone generating region above 20 kilometers. Since ozone is destroyed near the ground, a continual downward diffusion is occurring, and surface ozone measurements may shed some light on the magnitude of this downward diffusion. Preliminary results from Antarctic studies show that at Little America in winter there is about 25% more ozone at the ground than there is in New Mexico, and at Mauna Loa, Hawaii, there is a diurnal variation whose amplitude varies to 15% of the total.

Study of the distribution of carbon dioxide in atmosphere and ocean is vital to our understanding of the heat balance of the earth. Carbon dioxide, although present in the atmosphere in small quantity (about 320 parts per million), is important because of its absorption and re-radiation of heat energy in the form of infrared radiation. Our industrial civilization pours great quantities of carbon dioxide into the atmosphere but we do not know how much is dissolved in the oceans, how much is taken up by plant life, and how much remains in the atmosphere. We are now establishing a new reference level against which to measure future changes in the concentration of CO_2.

IGY studies of natural radioactivity and radioactive fission products in the atmosphere will assist in a better understanding of a number of meteorological phenomena such as air mass identification and movement; storage times of particulates in the troposphere and stratosphere; exchange processes between the stratosphere and troposphere; small and large-scale atmospheric diffusion; exchange between the atmosphere and the oceans; features of the large-scale circulation, including stratospheric transport; and the mechanism of precipitation scavenging.

In glaciology, the recovery of cores of ice at depths of more than 1000 feet makes possible the study of climate and precipitation covering many hundreds of years. The carbon-14 method is used to date the various ice layers by means of the organic material they may contain. Study of the ratio of O^{18} to O^{16} helps to determine the temperature conditions under which precipitation occurred in the formation of ice layers as well as assisting in determining the age of the ice. In addition, chemical studies of the atmospheric gases in glaciers determine their salt content, while analysis of natural and artificial radioactive constituents assists in the determination of the age of the ice.

In the IGY upper atmosphere program, the night air-

glow is studied. Airglow is a faint emission from a layer of the upper atmosphere at approximately 100 kms. Principal emissions observed are that of an oxygen (^1S—^1D) transition at 5577 *A*; and oxygen (^1D—^3P) transition at 6300 *A*; and the sodium doublet at 5890 *A* and 5896 *A*. There are also many *OH* bands, principally in the infrared. There are numerous other lines originating in the upper atmosphere but none have sufficent intensity to make observations practical with presently available methods.

The observing is done with photometers, which incorporate narrowband filters in the optical system, and photomultiplier detectors. The electrical signal is then amplified and recorded.

Significant new findings from these and other IGY experiments have already been made, and, with the increasing availability of data, we expect to add further to our knowledge of the universe. To ensure the safety of the raw data and their accessibility, three IGY World Data Centers, with complete sets of data at each center, have been set up. The first center is in the United States, the second in the Soviet Union, and the third in Western Europe and the Pacific.

Preliminary study of these data and the success of the IGY as an experiment in cooperative scientific effort have demonstrated the desirability of similar programs in the post-IGY period. Special committees already have been set up to continue Antarctic and oceanographic studies, and it is likely that other IGY-connected studies will be continued.

Apart from continued scientific efforts is the stimulus given to science education in this country and throughout the world by the IGY. In many ways this stimulus may prove the most important result to be attained.

FOLLOW-UP OF R.O.T.C.

(Continued from page 29)

1957

RONALD B. LANTZ

Army—University of Nebraska, Lincoln, Nebraska

Mr. Lantz, who is working for his M.S. degree in Chemical Engineering, writes:

"I completed the work for the B.S. degree in Chemical Engineering during the 1957-1958 school term and received the degree with distinction. I received my commission into the Chemical Corps in June of 1958.

"I was awarded the Phillips Research Fellowship at the University of Nebraska to do graduate work in chemical engineering. I am now doing research in the high pressure vapor-liquid equilibrium of a ternary system of hydrocarbons. I plan to receive the M.S. degree in Chemical Engineering in June of 1959."

CLAUDE E. SCHINDLER, JR.

Air Force—University of Cincinnati, Cincinnati, Ohio

Mr. Schindler, who majored in chemical engineering writes to Mr. Johnson:

"Due to changes of address, I just received your letter dated October 31, 1958. I am presently serving in the United States Air Force as a 2/Lieutenant, working in the IBM accounting machine section at Castle Air Force Base, California."

LT. JOHN H. WARREN

Army—University of Delaware, Newark, Delaware

Mr. Warren, a 1957 winner, in response to the inquiry, writes as follows:

"Upon graduation I was employed in the Fuels Division of Socony Mobile Oil Company's R&D Laboratories in Paulsboro, New Jersey. I was employed there for five months prior to my entrance on active duty. I entered the Signal School on 10 November 1957 and attended both the Signal Officers' Basic Course and Microwave Radio Officers Course, for which I was awarded the 0503 MOS.

"I reported to Fort Ord, California, to the 41st Signal Battalion, where I was appointed Radio Officer in one of the companies. Since arriving at Fort Ord, I've attended an Officers Refresher Course, and have been to a special school back at Fort Monmouth.

"On 15 September, 1958, I reported to the 121st Signal Battalion for a TDY period of two months to participate in Exercise Rocky Shoals.

"Presently, I have command of a detachment of 100 men at Camp Roberts, California and Hunter Leggett Military Reservation."

1958

JAMES LAWRENCE TROUT

Army—University of Cincinnati, Cincinnati, Ohio

Mr. Trout majored in Chemical Engineering. He writes:

"After graduation in June, I attended R.O.T.C. summer camp at Fort Bragg, North Carolina. From there I came to Port Arthur, Texas, to work for the Texas Company, as an associate engineer in their Research and Technical Department.

"On January 19, of this year, I report to Fort McClellan for six months training and active duty in the Chemical Corps."

KENNETH ISAO KAWANO

Army—Massachusetts Institute of Technology, Cambridge, Mass.

(Senior student in Chemical Engineering)

Mr. Kawano, last year's award winner, who is still in an under-graduate status, has not yet decided whether he will seek a permanent career in the Regular Army, or attend Graduate School for advanced study of organic chemistry at the University of Wisconsin.

Mr. Kawano, born in Hawaii, resides at Burton House, 410 Memorial Drive, Cambridge 39, Massachusetts.

HOW IDEA OF USING MUSTARD GAS FOR CANCER ORIGINATED

WASHINGTON (ANS)—The researches of the Army Chemical Corps have often resulted in valuable contributions to medical science.

One of the many examples is that of nitrogen mustard in the treatment of cancer.

During World War II a boatload of mustard was blown up in the harbor of Bari, Italy, where the liquid mustard mixed with fuel oil and became a floating contamination danger. Swimmers were reported in a state of shock, did not respond to treatment, and were found to have a reduction in white blood corpuscles.

Later the Army Chemical Center produced the same effects in test animals. Its scientists saw the possibility that mustard gas might benefit in the treatment of diseases in which there was an abnormal increase in white blood cells.

Mustard type agents, especially the nitrogen mustards, were tried on cases of Hodgkins disease, lymphosarcoma, and leukemia. The nitrogen mustards do not cure any form of cancer, but they do prolong life in many instances. Today, hospital clinics and laboratories throughout the nation are studying the mustard compounds as a possible treatment for some forms of cancer.

(Continued from page 16)

sumed by the heat generated during percussion of the round in the chamber, leaving only gaseous products. The proposed case for the 105-mm round will weigh about 2.5 pounds, or less than half the weight of the current, standard brass case.

The plastic shell-cases are made by injection-molding, which produces a high-impact thermo-plastic of greater density and more complete homogeneity than conventional methods. In tests conducted on them, these cases had to withstand gas pressures of up to 35,000 pounds per square inch and an interior flame-temperature of 4,000 °F. at the instant of percussion.

The proposed case, when perfected and standardized, will confer several important advantages: in addition to a reduction in weight of almost 60%, it is anticipated that the item will cost about 25% less; it makes use of no strategic materials, such as copper or zinc; it can be produced in various colors, useful for labeling different types of ammunition; and best of all, perhaps, its use on the battlefield and on the training ranges would leave no brass to police up! It is not difficult to see, logistically, the important savings to be realized from production, transportation, and employment of ammunition utilizing cases which disappear in a puff of fire and smoke.

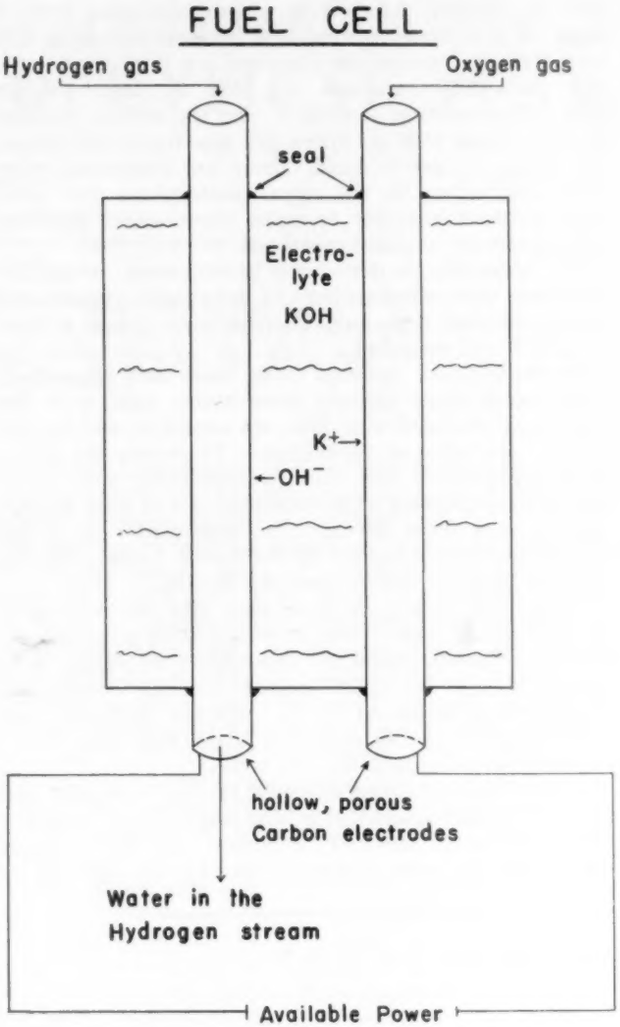
New Fuel Cell

THERE has recently been announced successful development by the Signal Corps of a new fuel cell capable of directly converting the chemical energy of gases into electricity. The cell will likely prove capable of producing economically thousands of watts of power. Based on the energy-producing chemical reaction between hydrogen and oxygen gases, this cell will provide silent electrical power for such items as the "Silent Sentry" miniature radar set, and may eliminate the need for bulky, noisy motor-generators in many other types of equipment.

The cell is essentially a sealed jar into which are fed hydrogen and oxygen gases through hollow carbon electrodes (Fig. 7). The gases diffuse through the porous carbon to its surface, where the electro-chemical reaction undergone produces an electric current, water being the only by-product. The closed electrical circuit is the result of electron-release at the hydrogen electrode, electron-acceptance at the oxygen electrode, and the ionic conductivity of the electrolytic solution. With the water disposed of by evaporation and removal, the life of the cell is theoretically unlimited. Although pure oxygen is required for the higher power ratings, the cell *can* be operated — for small, mobile units requiring lower power ratings — simply on a tank of hydrogen and the surrounding air.

Designed to operate under normal conditions of temperature and pressure, thus eliminating the requirements for bulky, expensive pressurizing equipment, the cell operates at an efficiency between 65% and 80%. Voltage across the electrodes is about one volt, but by varying the number and size of the cells, any desired voltage or current-strength can be obtained. Basically, the unit is most desirable for high-current, low-voltage use. Research and development to date indicate that the optimum fuel-cell design will be one which will produce approximately one kilowatt of power from a packaged unit one cubic foot in volume.

The inherent advantages of the fuel-cell appear to make it an ideal source of electrical power in remote locations where conventional fuels or water-power are not available, or in front-line areas where the premium is on *silent* operations. Military communications systems,



$$2\,(H_2 - 2e \longrightarrow 2H^+)$$
$$O_2 + 4e \longrightarrow 2O^=$$
$$2H_2 + O_2 \longrightarrow 2H_2O + \text{energy}$$

Schematic diagram of hydrogen-oxygen fuel cell. The electro-chemical reaction at the electrodes produces usual electric current.

Fig. 7

mobile power units, and emergency-stand-by power plants are but a few of the expected applications.

Plastic Mines

THE anti-tank mine formerly standard in the Army, the M15, was made of metal and weighed slightly over 30 pounds. There has since been developed by the Corps of Engineers a non-metallic mine, the M19, made of a polyester-resin fiberglass material. The new mine not only weighs slightly less than its metallic antecedent, but its explosive-charge-to-total-weight ratio is appreciably improved, as well. Approximately 77% by weight of the plastic mine consists of Composition B (22 pounds' worth), which is a mixture of TNT (40%), RDX (55%), and filler material. The mine is referred to lovingly as a tank-killer and is most assuredly guaranteed to give quite a rousing ovation to any enemy tanks lucky enough to roll over it.

Also currently standard is the M14 plastic anti-personnel mine, a potent little package of explosive smaller than a baseball and designed to make the enemy soldier's life quite miserable. Except for a small metallic firing-pin, both the M19 and the M14 are completely non-me-

The U. S. Army's protective mask, shown above, which eliminates the bulky canister of conventional models, is now undergoing rigid tests before it can be adopted as standard. Filtering of the inhaled air is accomplished by pads of material inclosed in cavities molded into the facepiece.
Fig. 8

tallic; this constitutes an important advantage, for the mines are thereby rendered virtually undetectable by magnetic mine-detectors.

Canister-less Protective Mask

WHEN toxic gases were suddenly employed against American troops in World War I, gas-masks were not yet available, so the most rudimentary expedients were employed for self-protection, such as breathing through a handkerchief soaked in ammonia. Through the years since then, developments in the mask have reduced the size of the canister, eliminated the hose, and improved the comfort of the mask.

The newest development in the protective mask (Fig. 8) is a revolutionary type which completely eliminates the bulky external canister. Filtering of the inhaled air is accomplished by pads of light-weight, pliable material enclosed in cavities molded into the facepiece. The filtering material includes a mechanical filter of long-fiber asbestos and a chemical filter of activated charcoal impregnated with various salts which catalytically accelerate the neutralization of certain highly-toxic nerve gases. The air-intake is centered under the wearer's nose, with the exhaust valve units on either side.

This mask, through its mechanical filtering, adsorption, and chemical neutralization action, provides superior protection against chemical and biological agents and radioactive particles. It is relatively light-weight, has excellent speech-transmission characteristics and very low breathing resistance, and appears to be a far more comfortable mask than any of its predecessors. Hopefully this mask will be standardized for issue by the Army, in the reasonably near future.

Rocket and Missile Fuels

NO EXAMINATION of the impact of chemical technology on the modern Army would be complete without some attention to the importance of chemistry to the rocket and missile program. Many chemical manufacturers and research laboratories, as well as various agencies of the Government, are concerned with this program. In the Army, responsibility for the development and provision of rockets and missiles, including fuels for same, is vested in the Ordnance Corps. In order to lift a rocket or missile off the ground and impart a velocity to it, energy must be supplied. To accomplish this, a fuel is burned, since all combustion reactions are energy-producing, or —as the chemist terms it — exothermic. The ideal fuel has several important characteristics: it has a high energy content, it is of relatively high density (so that large-volume fuel tanks will not be required), and — desirably — it is plentiful in nature or easily made. A survey of the known elements quickly brings to chemists' attention hydrogen. Since about 11% by weight of all the waters of the world is hydrogen, it is certainly an abundant material. Its energy content is enormous: combustion of hydrogen (in air) liberates about 13,200,000 calories for every pound of hydrogen burned. The fatal drawback to the use of hydrogen, however, lies in its physical state: under ordinary conditions of temperature and pressure, it is a gas, of extremely low density. In order to transport a sufficient amount of this fuel for missile purposes, a hydrogen-powered rocket would have to be large beyond belief. True, hydrogen gas can be liquified (at a temperature of 423 degrees below 0 °F.), and this reduces its bulk some 780 times, but rocket engineers are not anxious to build highly-complex compression, refrigeration, and insulation apparatus into each missile to be fired!

What is needed is some sort of chemical "sponge" or "bucket" in which to hold the hydrogen, preferably in a liquid (or even solid) state. Gasoline, kerosene, and Diesel oil are typical examples of hydrocarbon fuels, in which the hydrogen atoms are bonded to carbon atoms. These fuels are relatively abundant, and satisfy reasonably well the requirements as to bulk, but they are not particularly efficient fuels, in terms of energy yielded per pound of fuel. Having then largely exhausted the possibilities with hydro-carbon fuels, the fuel chemists must look elsewhere. Sitting down with the periodic table of the elements and a compilation of heats of combustion of known compounds of hydrogen, they painstakingly search out those hydrogen-containing materials whose chemical and physical properties make them the most promising. For optimum combustion products, the search logically begins at the "light" end of the table. Lithium compounds must be eliminated on an economic basis; the combustion-products of many beryllium compounds are highly toxic; but in the element boron they appear to have struck pay-dirt. A series of "boranes" are known, compounds in which hydrogen atoms are bonded—probably!—to boron atoms; the heats of combustion of these compounds, while not as high as that of pure hydrogen, are about 50% better than that of jet-fuel JP-4 (which is essentially kerosene, $C_{12}H_{26}$), making the boranes far more efficient fuels, on a pound-for-pound basis, than the hydrocarbon series. Some of the early members of the series, such as di-borane (B_2H_6), and tetra-borane (B_4H_{10}), are unsuitable, either because they, too, are gases under normal conditions of temperature and pressure or because they are unstable, but such compounds as penta-borane (B_5H_9, a liquid), deca-borane ($B_{10}H_{14}$, a solid), and certain hydrocarbon-substituted derivatives of the boranes are most promising. Much work on these compounds remains to be done — their exact molecular structure, for example, is still quite a mystery to chemists—but their development as rocket fuels appears to constitute a giant step forward.

(Continued on page 38)

CHEMICAL CORPS NEWS

LAST RITES FOR COLONEL KING

Military services for Colonel De Lancey Rice King were held at the Fitzsimmons Army Hospital Chapel, Denver, Colorado, at 10 AM, Friday, 9 January.

Colonel King died on January 6, following a heart attack. (A brief notice of his death was published in the last issue of THE JOURNAL.)

Colonel King, who was awarded the Distinguished Service Cross in World War I, and won additional honors, including the Legion of Merit with Oak Leaf Cluster for his services in World War II, had long been on active duty in the Chemical Corps.

At the funeral services in Denver, the pallbearers were: Brigadier General J. H. Rothschild, Lt. Colonel Dick Coburn, Major Watts Clarke, Major Charles M. Shadle, 1st Lieutenant John Harper, and M/Sgt. Gerald King. The Honorary pallbearers were: Brigadier General Charles S. Shadle, Colonel C. M. Kellogg, Colonel William J. Allen, Jr., Major Symore Shwiller, Major Peter Orth, Mr. Richard Ruhland, Mr. Arch Mack, Mr. Norman S. MacDonald, Mr. Kenneth Cabble, Mr. C. J. Dunbar, Sgt. Oliver W. Franklin, Dr. Maurice Gaon, and Dr. Robert Squires.

DR. RABL, FORMER CHEMICAL CORPS EMPLOYEE, DIED DEC. 21

GIESSEN, Germany (Special) —Dr. Alfred Rabl, 56, chief of the Testing Section, Laboratory Branch, Procurement Inspection Division, US Army Quartermaster Supply Center, Giessen, died at the US Army Hospital, Frankfort on the Main, Germany, on December 21, 1958. Interment was at Cedar Park Cemetery, Westwood, N.J.

Dr. Rabl was a member of A.F.C.A., and had been a civil service employee of the US Army in Germany continuously since July 1947, including service with the chemical laboratory at the Hanau Chemical Depot.

A native of Linz-Kleinmuenchen, Austria, Dr. Rabl came to the United States in 1940 and became a naturalized citizen in 1946. He was awarded the degree of doctor of philosophy by the University of Vienna in 1925.

SCIENTIFIC CBR SUBPANEL MEETS AT CHEMICAL CENTER

ARMY CHEMICAL CENTER, Md.—Some of the principal delegates to the recently concluded session of the CBR subpanel of the Army Scientific Advisory Panel held here take time out from the conference to discuss progress and accomplishments of the panel meetings. They are, left to right: Dr. Charles E. Waring, subpanel chairman and head of the University of Connecticut Chemistry department; Major General Marshall Stubbs, Army Chief Chemical Officer; Dr. Harold Weber, Chief Scientist of the Army; and Brigadier General F. H. Britton, Military consultant to the panel, representing the Chief of Research and Development.

FIRST VOLUME OF ARMY CWS HISTORY IN PRESS

The Chemical Warfare Service in World War II, Organizing for War, a volume in the series THE UNITED STATES ARMY IN WORLD WAR II, is expected to be published by the Government Printing Office late this spring or early this summer. This volume, which was written by Dr. Leo P. Brophy and the late Colonel George J. B. Fisher, discusses the Chemical Warfare Service (now Chemical Corps) mission, organization, personnel management and military training programs from the time of the activation of the CWS in World War I up through World War II. Work on the two additional volumes of the CWS series is at an advanced stage.

COL. FELLENZ IS ASSIGNED AS PLANS AND DOCTRINE CHIEF

ARMY CHEMICAL CENTER, MD. — About 150 people attended a farewell dinner given here in January for Colonel Lloyd E. Fellenz, commanding officer of the U.S. Army Chemical Warfare Laboratories.

Colonel Fellenz, who has commanded the Laboratories since 1956, has a new assignment in Washington as Assistant Chief Chemical Officer for Planning and Doctrine.

Mr. Edmund H. Schwanke was the toastmaster. The speakers scheduled included Brigadier General Graydon C. Essman, who heads the Chemical Corps Research and Development Command.

The dinner was a farewell tribute by the military and civilian employees and an illustrated scroll, signed by hundreds of his friends, was presented to Colonel Fellenz as a memento.

Before his assignment here Colonel Fellenz served as chief of the chemical section of the Continental Army Command. A 1934 graduate of West Point, he has also held staff assignments in Washington, and served in the Mediterranean Theater of Operations during World War II.

Colonel Donald E. Yanka replaces Colonel Fellenz as commander of the Chemical Warfare Laboratories.

COL. YANKA TAKES COMMAND OF CHEMICAL WARFARE LABORATORIES

EDGEWOOD, Md. — Colonel Donald E. Yanka, who returned from Korea where he served as Eighth Army Chemical Officer, has assumed command of the Chemical Warfare Laboratories at the Army Chemical Center. He succeeds Colonel Lloyd E. Fellenz, recently assigned to duty in Washington, D.C.

A native of Michigan, Colonel Yanka has a BS degree in chemistry from Western Michigan College, Kalamazoo.

During World War II he commanded the 89th Chemical Mortar Battalion in combat operations with the 30th, 35th, 79th, 29th and 4th Infantry Divisions and the 82d Airborne Division.

Subsequent assignments included command of the Hanau Chemical Depot, Hanau, Germany.

Colonel Yanka is a graduate of the Command and General Staff College, the Armed Forces Staff College, and the Army War College.

COL. GROTHAUS TO HARVARD

FORT DETRICK, Md.—Colonel Donald G. Grothaus, Commanding Officer of the U.S. Army Biological Warfare Laboratories, Fort Detrick, has been selected to participate in the Advanced Management Program at the Harvard University Graduate School of Business Administration from February 18 to May 15.

THE ARMY CHIEF OF STAFF GREETS GEN. AND MRS. STUBBS AT RECEPTION

General Maxwell D. Taylor, Chief of Staff, United States Army (right) with Army Chief Chemical Officer Major General Marshall Stubbs and Mrs. Stubbs at a reception honoring General and Mrs. Stubbs at Fort Myer, Virginia, October 9, 1958.

COL. BARTLING NEW DEPUTY CML.C. TRAINING COMMANDER

FORT McCLELLAN, Ala. — Colonel Carl W. Bartling, formerly Chief, Plans and Training Division, has been appointed Deputy Commander of the U.S. Army Chemical Corps Training Command, Ft. McClellan, Ala.

Colonel Bartling, who was recently promoted to the grade of Colonel, is a native of Litchfield, Ill. A veteran of over 17 years of Army service, he has seen action in five World War II campaigns, and has also served in Korea.

PINE BLUFF WINS NATIONAL SAFETY AWARD THIRD TIME

SAFETY AWARD—Col. Russell W. Dodds (right), commander of the Chemical Corps' Pine Bluff (Ark.) Chemical Arsenal, receives the National Safety Council Award of Honor for outstanding safety performance during the 1958 fiscal year. Brig. General Harold Walmsley, commander of the Chemical Corps Materiel Command, made the award. In a letter following the award, Major General Marshall Stubbs, Army Chief Chemical Officer, praised arsenal personnel on the "greatest improvement in accident prevention for the past fiscal year." The presentation marked the second consecutive award to Pine Bluff and the third such award in the past four years.

NEW HONOR FOR DR. WEBER

Dr. Harold C. Weber, who was recently appointed Chief Scientific Advisor to the Army in the Office of the Chief, Research and Development, was presented the Department of the Army Meritorious Civilian Service Award by Army Chief Chemical Officer, Major General Marshall Stubbs, at a dinner at Army Chemical Center, Maryland, on January 12.

The award was made to Dr. Weber for his outstanding contributions to the Chemical Corps while serving as chairman of the Chemical Corps Advisory Council since March 1955.

Dr. Weber is Professor of Chemical Engineering at Massachusetts Institute of Technology. During World War II, he served as technical advisor to the Chemical Warfare Service Development Laboratory for which he received the Presidential Certificate of Merit for outstanding achievement.

Dr. Weber is a fellow of the American Association for the Advancement of Science and is a Director-at-Large of the Armed Forces Chemical Association.

CHEM. CORPS GROUP ATTENDS NAVY RAD LAB CONFERENCE

Five members of the Chemical Corps were among thirteen representatives of the Army Technical Services who visited the U.S. Naval Radiological Defense Laboratory at San Francisco, California, last November. The occasion was a conference for preliminary discussion of recommendations for the Army's program at this Laboratory in fiscal year 1960-1961. These were Major Gregg Henry, Department of the Army Liaison Officer at the Laboratory; Major Howard G. Schade, Office of the Chief Chemical Officer; Mr. Joseph Lindwarm, Chemical Warfare Laboratories, Army Chemical Center, Maryland; Captain Harold C. Kinne, Jr., Headquarters, Chemical Corps R&D Command; and Captain David W. Einsel, Jr., Office of the Chief Chemical Officer.

MAJOR GEORGE IS HONORED ON RETIREMENT AFTER 20 YEARS

Major Clair L. George, on the occasion of his retirement from the Army after 20 years service, was honored at a dinner party at the New Cumberland (Penna.) General Depot on November 21, 1958, and awarded a "Certificate of Achievement" by Colonel Charles E. Capito, the Depot Commander.

Major George, whose last duty assignment was Chemical Supply Officer of the Depot, was born in Aspers, Pennsylvania, and now resides at Brodbecks, R.D.#1, Pennsylvania. He served the World War II period in Europe and the Far East and was wounded in action during service in Korea in 1950. His awards include the Bronze Star Medal; Commendation Ribbon with Metal Pendant and Oak Leaf Cluster; the Purple Heart; and the Soldier's Good Conduct Medal. Major George began his military career as a private in the Coast Artillery Corps in 1937. He was commissioned second lieutenant in 1942.

ROCKY MTN. MEDICAL EXPERT ON NERVE GAS TO PRESENT PAPER

A paper entitled "Studies of Accidental Exposures to GB Nerve Gas" is one of the Chemical Corps papers selected for presentation at the Army Science Conference to be held at the U.S. Military Academy, West Point, 24-26 June 1959.

The paper was written by Dr. Maurice D. Gaon, 29 Dexter Street, Denver, Colorado, a graduate of the University of Pisa, Italy, and considered one of the foremost experts in the world on medical effects of nerve gas. Dr. Gaon has been Medical Director at Rocky Mountain Arsenal for over ten years. He holds a commission of Lt. Colonel in the U.S. Army Reserve.

Colonel William J. Allen, Jr., Commanding Officer of the Arsenal, in the accompanying picture is presenting Dr. Gaon a letter of commendation from Brig. General Harold Walmsley, Commanding General of the U.S. Army Chemical Center and Chemical Corps Materiel Command, notifying the Denver doctor of the selection of his paper by the Army.

INCENTIVE AWARDS COMMITTEE IS APPOINTED AT PINE BLUFF

Colonel Russell W. Dodds, Commanding Officer, Pine Bluff Arsenal, has announced a periodic reorganization of the U.S. Army's Incentive Awards Committee at the Arsenal. Heading the new committee is Mr. Frank W. Letzig, Jr., a division chief and director of biological operations. The alternate chairman is Mr. William L. Heroman, chief of the engineering branch, engineering and services division.

Pictured herewith are members of the new committee: Left to right (sitting): Frederick E. Jansonius; Major Francis M. Robertson; Frank W. Letzig, Jr.; William L. Heroman, and Robert B. Mann. (Standing) Mrs. Bernice White; Oliver B. McClaran; Marcus Varnell, and Mrs. Frances Garing.

"LADY SURGEON" JOINS ACC MEDICAL RESEARCH STAFF

EDGEWOOD, MD. — Major Janice A. Mendelson, is one of the U.S. Army's tiny handful of "lady surgeons." There are only eight of them.

Assigned to Army Chemical Center here last November, Major Mendelson heads a research program designed to develop better methods for rapid and simple treatment of the injured in a mass casualty situation such as would be encountered in an atomic blast.

Daughter of an old-line Army doctor, Janice Mendelson set her sights early on a career as a surgeon. "I really didn't think it would be possible for a woman," she recalls, "but I kept hoping that somehow I could work it out."

Work it out she did. Formal schooling for this little girl with big ideas began in China, where her father was stationed by the Army for a three-year tour. Next came a Wyoming assignment. But after that her father— Dr. J. A. Mendelson, now superintendent of Dayton State Hospital in Dayton, Ohio—retired from the Army and he bundled up his much-traveled family and headed back to Tientsin, China, to set up a private practice.

There young Janice plowed through a rigorous high-school course, maintained for English-speaking children by Britain's Cambridge University.

As war clouds settled ominously across the Far East in the late 1930's, the Mendelsons were forced to flee the country. The family barely escaped before the Japanese descended.

Back in the United States, still minus a high school diploma, Janice Mendelson enrolled in Roosevelt High School in Washington, D.C. After graduation she entered Wilson Teachers College in Washington, obtained a B.S. degree, then went on to the University of Pittsburgh School of Medicine for her M.D. The final step came in 1952 when Dr. Janice Mendelson received a degree in surgery from Ohio State University.

She went to work, and in 1955, was a board-certified practicing surgeon in Dayton, Ohio.

Then she joined the Army. Why?

"There are several reasons," answers Dr. Mendelson. "One was travel. It's in my blood, a holdover from childhood.

"Then there's another reason. While working in hospitals, I saw many young male doctors, most of them with families, called into the Army.

"I looked at it this way: I had no family responsibilities, and I didn't need the money—which is certainly better outside, of course. So I decided that by coming into the Army, I might replace one male doctor, who couldn't so easily afford to come, on the list of those to be called."

That was three years ago. Her verdict today: It was a good decision.

"So far, I've been doing general surgery (at Valley Forge Army Hospital, Pa., and Fort Bragg, N.C.)."

Today, Major Mendelson is chief of the Traumatic Investigations Branch of the Army's Chemical Warfare Laboratories here.

"This type of research is new to me, and I'm just now getting started. Our job—finding better ways of treating mass casualties—is vitally important," she emphasizes.

PROFESSIONAL ENGINEERS PREP COURSE AT FORT DETRICK, MD.

A professional engineers preparatory course has been initiated at Fort Detrick, Maryland. Established through the efforts of Mr. Paul H. Teare, BW Plants Division (Directorate of BW Engineering), the course was adapted from the Corps of Engineers. The project is expected to raise the professional level of the BW Engineering Directorate and of engineering personnel of other participating Biological Warfare laboratories.

The Professional Engineer Prepartory Program is sponsored as a voluntary effort to further the professional development of military and civilian engineering employees at Fort Detrick. Authorities note that military engineering is becoming more and more complicated and is requiring greater contact with professional engineers in industry. It is believed that registration as a professional engineer should do much to further these relationships.

Study classes are to be conducted on a small group, seminar type basis, with nine students per group meeting twice weekly for two-hour periods. BW Engineering Directorate personnel participating in the program are Mr. Ira Abelow, Mr. Everett E. Champlin, Mr. Edgar B. Harrod, Jr., Mr. Henry Hintze, Mr. Harry A. Jennings, Mr. Clayton C. Ward, and Mr. Paul H. Teare.

Career Opportunities

Apparatus Design—An excellent chance to make your contribution to science by designing the laboratory instruments and appliances of the future. Interesting, challenging work in an atmosphere of creative professional accomplishment and real individual responsibility and recognition. Fine salary, benefits, educational and cultural opportunities in dynamic Pittsburgh. B.S. Chemistry, Physics or Mechanical Engineering, plus demonstrable design ability required.

Sales Training—An honest-to-goodness laboratory sales training program, available in such major cities as New York, Chicago, St. Louis, Pittsburgh, Montreal, Toronto, Philadelphia and Washington, D.C., leading to assignment to your own territory. Salary, commissions, car and expenses, plus liberal benefits. B.S. Chemistry or equivalent required; 2 to 3 years analytical laboratory experience preferred.

Check Your Opportunity—by sending résumé to S. G. DeCHANT, Director of Personnel, 721 Forbes Avenue, Pittsburgh 19, Pennsylvania.

FISHER SCIENTIFIC COMPANY

America's Leading Manufacturer-Distributor
of Laboratory Apparatus and Reagents

AWARDS FOR MERIT

Following is a list of awards to personnel of the Army Chemical Corps during recent months.

OFFICE OF THE CHIEF CHEMICAL OFFICER: Cash awards totaling $1250 as follows:

For suggestions, to—**William J. Bailey; Edward R. Comstock; Charles D. Izac; Mary G. Jarvis;** and **Clara V. White.**

For superior job performance, to—**George B. DeGennaro; Betty J. Erskine; Harold V. Morgan; William F. Wellington; Kathryn L. Martin;** and **Helen Skapura.**

Also performance award certificates to—**Vallaire R. Dallier; John G. Dudley, Jr.; Morris F. Lee; John A. Hall, Jr.; Vauda M. Owendoff;** and **Norris E. Sills; C. Grant Ash; Evelyn V. Becker; Alma F. Kieny; Inez W. Meredith;** and **Daniel J. Shearin.**

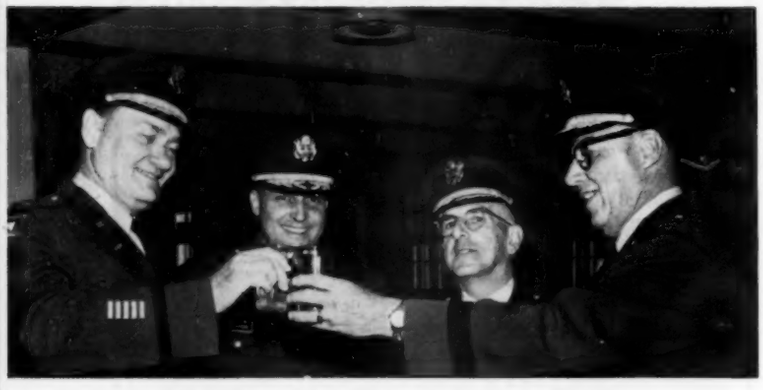
ARMY CHEMICAL CENTER-CHEMICAL WARFARE LABORATORIES: Certificates and cash awards—

For superior performance of duty to—**Charles L. Punte, Jr.; John T. Weimer; Edmund J. Owens, Jr.; Louis E. Gongwer; Willie Mae Lawson** and **William V. Blevins.**

ARMY CHEMICAL CENTER-CHEMICAL CORPS ADVISORY COUNCIL: For special service and outstanding performance of duty—$200 cash award to **Dr. Carl B. Marquand,** Executive Director of the Council $100 cash award to **Marion P. Barras** (closed microphone reporter with the Council).

U.S. ARMY CHEMICAL PROCUREMENT DISTRICT, NEW YORK: For sustained superior performance—**Frank W. Klimm; John S. Szala, Jr.** Suggestion award to—**Bernice Caspary; Cecil M. Bynoe; Paul Aaronberg;** and **Jerome Kramer.** For meritorious service—**Minerva A. Sowers;** and **Bernice Caspary.**

U.S. ARMY CHEMICAL ARSENAL, PINE BLUFF, ARKANSAS: For sustained superior performance—**Etoyle W. Walter, (Mrs.);** and **Ben C. Shipp.**



FLUORINATED WATER AT ACC NOW

EDGEWOOD, MD.—"To Your Very Good Dental Health, Sir!"—could be what Colonel Eugene G. Bennett, deputy post commander (left) is saying as he offers a toast in fluoride treated water to Army Chief of Dental Service, Major General James M. Epperly (right). Observing the ceremony are Lt. Colonel James T. Thompson, Army Chemical Center Dental Surgeon (second from left) and Second Army Dental Surgeon, Colonel Samuel R. Haven. General Epperly, on a recent visit to the post, was shown the water treatment plant here where controlled quantities of Sodium Silica Fluoride are now introduced into the post water supply. The fluoridation system adopted after several years study, it is hoped, will provide the dental health of all the residents.

RUTH A. KING, WAC OFFICER IS PROMOTED TO MAJOR

Captain Ruth A. King, of the Women's Army Corps, assistant chief of the Technical Information Division, Chemical Warfare Laboratories, Army Chemical Center, was recently promoted to the grade of Major. Major King received a commission in the Regular Army in the grade of Captain in February 1958.

Major King is a native of Philadelphia where her parents, Mr. and Mrs. Walter S. King reside.

MAJOR HAHN WYNNE COMMENDED

Major Hahn Wynne, Composite Supply Co. U.S. Army Supply and Maintenance Center, Alaska, was recently awarded the Army's Commendation Ribbon with Metal Pendant for outstanding performance of duty while assigned as transportation officer at the U.S. Army Chemical Center, Maryland.

Major Wynne is stationed at Fort Richardson, Alaska.

TWO NEW SUPERGRADERS AT ACC

M/Sgt. Paul G. Little (left) and M/Sgt. Robert A. Bruce, Army Chemical Center's first master sergeants to be promoted to the rank of E-8, are congratulated by Brig. General Harold Walmsley, post commander. The men were promoted under a newly initiated Army program which provides for the "supergrades" of E-8 and E-9, open to outstanding veteran master sergeants. Little and Bruce were named from a field of nearly 100 eligible sergeants on the post.

CHEMISTRY AT WORK

(Continued from page 33)

And this does not take into consideration even more exotic concepts, such as ion-propulsion, free radicals, excitation of inert gases, and propulsion via nuclear energy.

* * *

The discussion above constitutes little more than a survey of a few of the representative ways in which chemistry makes its impact on the Army of today. The applications of chemistry are not unique to the Chemical Corps, nor to the Engineers, nor to the Ordnance Corps—in fact, virtually every branch of the Army is vitally concerned, directly or indirectly, with chemical science and technology. If it may be permitted to borrow (and modify) a slogan from one of the largest chemical houses in the country, it may be accurately said that the mission of all this developmental work is: "Better items . . . for a better Army . . . through Chemistry."

IMPROVING OUR CAPABILITIES

(Continued from page 8)

on their way. The actual lift would not be released for use without the specific approval of the Joint Chiefs of Staff.

I do not suggest that such preplanning should cause a certain number of planes or ships to stand idle, marked "For Army Use Only." That makes no sense to me. However, it would make a great deal of sense if the Army knew in advance that in an emergency, a given amount of lift would be available at designated airfields and ports, ready for movement on JCS approval. This knowledge would contribute materially to realistic planning for the rapid reaction of our spearhead units to limited war situations. I should add that the possibility of effective coordination of such preplanning will be facilitated by the new Joint Staff authorized by the recent reorganization act of the Department of Defense.

In this phase of Defense reorganization, I would like to say that, in my judgment, this legislation and its implementation now in progress, represents a major step forward in the achievement of an organization better able to deal with the military exigencies of today and the future. One important use of the new Joint Staff should be directed toward the accomplishment of the fourth point of the Limited War Program; namely, expanded joint planning and training for limited war. Such joint action might include the checking and testing of plans for overseas movement of forces, the verification of their readiness, and the actual movement of token forces as training for emergency situations. I should like to feel that we are as effective in meeting the complex requirements of limited war as SAC is in meeting the requirements of general atomic war. I think SAC is a most impressive military organization. Its complete dedication to readiness in its particular field is most impressive. I should like to find a similar intentness on the limited war problem.

Advises Publicizing Capabilities

THE final point of the five-point program is to make clear to the world our readiness to react adequately anywhere to the challenge of aggression. To many observing America from a distance, we appear to be a country prepared to fight in case a general war should be forced upon us, but with unknown resources for a lesser response. It is highly important for psychological reasons to publicize our capabilities to react with weapons and means short of those associated with massive retaliation. This evidence of readiness could be attained through exercising and testing our limited war forces. Illustrative of what I have in mind was a small operation on a limited scale about three years ago in Thailand. We sent a joint airborne, seaborne task force into this area for the purposes I have described. The Army furnished an HONEST JOHN rocket unit from Japan, a Marine unit and Navy ships participated, as did planes of the Tactical Air Command. The task force was assembled in Bangkok in about forty-eight hours. This exercise made a very significant impression in Southeast Asia as a token demonstration of the reaction capability of American forces in that area.

In conclusion, I would stress again that I am not preaching a purely Army program. All Services would be involved in this five-pronged effort to improve our effectiveness in limited war. It is an essential extension of our national policy. We must overcome any impression that we are a country which can respond with a big bomb and little else. Alhough we have significant assets now to cope with limited wars, these can and must be improved so that it can be made crystal clear to both our friends and foes that we can respond promptly with proper weapons and proper forces to any challenge. It is the purpose of the Army to develop its strength in such a way that it may play its indispensable part in presenting this flexible military capability to the world.

ARMED FORCES DAY

(Continued from page 4)

Area Commander: Rear Admiral Emmet P. Forrestel, Commandant, Ninth Naval District, Great Lakes, Ill.

Project Officer: Captain C. R. Herms, USN

AREA II (Arkansas, Louisiana, New Mexico, Oklahoma, Texas)

Area Commander: Lt. General Frederic H. Smith, Jr., Commander, Air Training Command, Randolph AFB, Texas

Project Officer: Lt. Colonel Charles H. Harris

AREA III (Arizona, California, Idaho, Montana, Nevada, Oregon, Utah, Washington)

Area Commander: Major General Sory Smith, Commander, Fourth Air Force, Hamilton Air Force Base, California

Project Officer: Colonel Jack W. Saunders

AREA IV (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont)

Area Commander: Lt. General Blackshear M. Bryan, Commanding General, First U. S. Army, Governors Island, New York

Project Officer: Colonel John J. Kelly

AREA V (Delaware, Kentucky, Maryland, Ohio, Pennsylvania, Virginia, West Virginia)

Area Commander: Rear Admiral Ephriam R. McLean, Jr., Commandant, Fourth Naval District, Norfolk, Virginia

Project Officer: Captain John J. Becker, USN

AREA VI (Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee)

Area Commander: Lt. General Clark L. Ruffner, Commanding General, Third U. S. Army, Fort McPherson, Georgia

Project Officer: Colonel Harry A. Schendel, Jr.

AREA VII (District of Columbia and the neighboring areas of Maryland and Virginia which are within the Military District of Washington)

Area Commander: Rear Admiral William K. Mendenhall, Jr., Commandant, Potomac River Naval Command, Washington, D. C.

Project Officer: Captain William J. Galbraith, USN

OVERSEAS

ALASKAN COMMAND

Commander: Lt. General Frank A. Armstrong, Jr., USAF, Commander in Chief

Project Officer: Lt. Colonel Philip D. Watchel, Jr.

ANTILLES DEFENSE COMMAND

Commander: Rear Admiral D. V. Gallery, USN, Commander Antilles Defense Command

Project Officer: Commander R. M. Hartmann, USN

CARIBBEAN COMMAND

Commander: Lt. General Ridgely Gaither, USA, Commander in Chief

Project Officer: Lt. Colonel Miroslav F. Moucha, USA

EUROPEAN COMMAND

Commander: General Lauris Norstad, USAF Commander in Chief

Project Officer: Mr. Edward Pope

PACIFIC COMMAND

Commander: Admiral Harry D. Felt, USN Commander in Chief

Project Officer: Captain LeRoy C. Simpler, USN.

THE HISTORICAL CORNER

By Brooks E. Kleber*
Historical Office, Chemical Corps

TRAGEDY IN SLOAN COURT, EAST

The United States Army during World War II activated thirty-nine chemical processing companies to provide for the impregnation of clothing in case of gas warfare. (They were originally called impregnating companies). One of these companies was the 130th. Activated at Camp Sibert, Ala., the unit underwent extensive training in the United States before shipping out to England. It arrived in London in May 1944 and was billetted in a residential section in Sloan Court, East. The company immediately began to erect its impregnating plants, not to process clothing but to provide the services of a laundry, one of its secondary missions. This activity was temporarily abandoned in face of far more pressing business.

The arrival of the company in London just about coincided with the beginning of Germany's V-1 rocket campaign against England. The men of the 130th, after receiving training from British Rescue Squads, soon participated in the rescue and evacuation work which followed in the wake of the buzz bomb attacks. They spent the weekend of 1-2 July performing this mission of mercy and were scheduled for a repeat performance on the following day.

The men had an early breakfast that Monday morning and at 0730, outside their Sloan Court quarters, were beginning to climb aboard the trucks that would take them to the scene of the latest bombing. Suddenly, a V-1 bomb came out of the early morning haze heading straight for the company billets. There was time only for the briefest of warnings shouted by the company commander and several others.

Unfortunately, there was no time for the men who had boarded the truck to take shelter. And as the truck was right in the path of the buzz bomb it is doubtful whether any of its occupants escaped. Others dove around corners and into cellars. The blast of the bomb completely destroyed one of the company buildings and heavily damaged two others. Some of the men walked out of the wreckage. Others were trapped in the twisted remains of the billets, and were additionally endangered by the fire which broke out almost immediately.

Rescue squads began their work at once. Most of the men were trapped for several hours. One soldier, protected by arches of broken timber, was pulled out of the wreckage four days later.

The casualty list was appalling. Of the 148 men assigned to the company, 61 were killed or died of wounds and 37 were injured. This left fifty in the company who were unharmed by the explosion. Ten of these were not in the area when the bomb landed, a fact which increases the percentage of casualties among those involved.

The company moved to a small camp in Essex to receive and retrain the necessary replacements. It had been scheduled for a July movement to France. Its place was taken by another unit.

*Member of the Staff, Historical Office, office of the Chief Chemical Officer.

Pictures herewith show wreckage at Sloan Court, East, London, July 3, 1944.

*This column is based on a wartime history of the 130th Processing Company and data supplied by Maj. Ralph L. Aldrich, CmlC.—Author.

GROUP AND SUSTAINING MEMBERS

OF THE ARMED FORCES CHEMICAL ASSOCIATION

Abbott Laboratories, North Chicago, Ill.
Adache Associates, Inc., Engineers, Cleveland, Ohio
Air Reduction Company, Inc., New York, N.Y.
Allied Chemical Corporation, New York, N.Y.
American Cyanamid Company, New York, N.Y.
American Zinc, Lead & Smelting Co., St. Louis, Mo.
Armour & Company, Chicago, Ill.
Armstrong Cork Company, Lancaster, Pa.
Astra Pharmaceutical Products, Inc., Worcester 6, Mass.
Atlas Powder Company, Wilmington, Del.
Barnebey-Cheney Company, Columbus, Ohio
Bechtel Corporation, San Francisco, Calif.
Becton, Dickinson and Company, Rutherford, N.J.
Bell & Gossett Company, Morton Grove, Ill.
Blaw-Knox Company, Pittsburgh, Pa.
Brown Company, Berlin, N.H.
Casco Products Corporation, Bridgeport, Conn.
Celanese Corporation of America, New York, N.Y.
City Chemical Corp., New York, N.Y.
Columbia-Southern Chemical Corp., Pittsburgh, Pa.
Commercial Solvents Corporation, New York 16, N.Y.
Continental Can Co., Inc., Chicago, Ill.
Continental Oil Co., Ponca City, Okla.
Crane Co., Chicago, Ill.
Diamond Alkali Company, Cleveland, Ohio
Dow Chemical Company, Midland, Mich.
E. I. duPont de Nemours & Co., Inc., Wilmington, Del.
Edo Corporation, College Point, N.Y.
Engelhard Industries, Newark, N.J.
Esso Research and Engineering Co., New York, N.Y.
Evans Research & Development Corp., New York, N.Y.
Federal Laboratories, Inc., Saltsburg, Pa.
Ferguson, H. K., Company, The, Cleveland, Ohio
Ferro Corporation, Cleveland, Ohio
Firestone Industrial Products Co., Fall River, Mass.
Fisher Price Toys, Inc.. East Aurora, N.Y.
Fisher Scientific Co., New York, N.Y.
Fluor Corporation, Ltd., The, Whittier, Calif.
Food Machinery & Chemical Corporation, New York, N.Y.
Foster Wheeler Corporation, New York, N.Y.
Fraser & Johnston Co., San Francisco, Calif.
General Aniline & Film Corporation, New York, N.Y.
General Electric Company, Chemical & Metallurgical Division, Pittsfield, Mass.
General Tire & Rubber Company, The, Wabash, Ind.
Goodrich, B. F., Chemical Company, Cleveland, Ohio
Handy & Harman. New York, N.Y.
Harshaw Chemical Company, The. Cleveland. Ohio
Harvey Aluminum, Torrance, Calif.
Hercules Powder Company, Wilmington, Del.
Heyden Newport Chemical Corporation, New York, N.Y.
Hooker Chemical Corporation, Niagara Falls, N.Y.
Industrial Rubber Goods Company, St. Joseph, Mich.
International Nickel Co., Inc., New York, N.Y.
International Salt Co., Inc., Scranton, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Kennecott Copper Corporation, New York, N.Y.
Koppers Company, Inc., Pittsburgh, Pa.
Lambert-Hudnut Mfg. Laboratories, Inc., Lititz, Penna. subsidiary of Warner-Lambert Pharmaceutical Company, St. Louis, Mo.
Eli Lilly and Co., Indianapolis 6, Ind.
Little, Arthur D., Inc., Cambridge, Mass.
Lummus Company, The, 385 Madison Ave., New York, 17, N.Y.
Mason, L. E., Company, Hyde Park, Mass.
Merck & Company, Inc., Rahway, N.J.
Mine Safety Appliances Co., Pittsburgh, Pa.
Minnesota Mining & Manufacturing Co., 900 Fauquier Avenue, St. Paul, Minnesota
Miracle Adhesives Corp., 250 Pettit Ave., Bellmore, Long Island.
Monsanto Chemical Company, St. Louis, Mo.
National Cylinder Gas Co.—Chemical Div., Chicago 11, Ill.
Niagara Blower Co., New York, N.Y.
Olin Mathieson Chemical Corp., East Alton, Ill.
Oronite Chemical Company, San Francisco, Calif.
Pemco Corporation, Baltimore, Md.
Pennsalt Chemicals Corporation, Philadelphia, Pa.
Pfizer, Chas. & Company, Inc., Brooklyn, N.Y.
Phillips Petroleum Company, Bartlesville, Okla.
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.
Proctor & Gamble, Cincinnati, Ohio.
Reynolds Metals Company, Louisville 1, Ky.
Shea Chemical Corp., Jeffersonville, Ind.
Shell Chemical Corp., Denver, Colo.
Shell Development Company, Emeryville, Calif.
Sheller Mfg. Co., Dryden Rubber Div., Chicago, Ill.
Shwayder Bros., Inc., Denver, Colo.
Standard Oil Company (Indiana), Chicago, Ill.
Stauffer Chemical Company, New York, N.Y.
Sun Oil Company, Philadelphia, Pa.
Union Carbide Corporation, New York, N.Y.
United-Carr Fastener Corp., Cambridge, Mass.
Universal Match Corp., Ferguson, Mo.
Vitro Corporation of America, New York, N.Y.
Vulcan-Cincinnati, Inc., 120 Sycamore St., Cincinnati 2, Ohio
Witco Chemical Company, Chicago, Ill.
Wyandotte Chemicals Corp., Wyandotte, Mich.

Companies listed in bold face type are Sustaining Members

GOOD TIME TO TRIM FAT

from needless caustic soda costs!

Columbia-Southern's experience in manufacturing and selling quality caustic soda convinces us that many caustic users can effect appreciable savings on their current costs. Isn't this the ideal time to see if this applies to your caustic consumption?

Let's take the *form* of caustic you are buying and handling. Are you quite sure that new or projected changes in your products or processing won't be benefited by purchasing liquid, rather than anhydrous? Or vice versa? Or 73% liquid, rather than 50%? Do you have reliable figures on diluting and storing the stronger concentration? How about the facts on completely up-to date unloading techniques and equipment?

How about the uniform *quality* of the caustic you are receiving? Here again, Columbia-Southern can advise you with the authority of recognized experience. As a matter of record, we have led in developing improved tank car linings, heating, insulation, and safety features . . . patented unloading and dilution processes . . . economical waterways delivery.

Our well-grounded Technical Service engineers have helped customers save thousands of dollars in buying and using caustic soda. Isn't it good business, especially *now*, to see what savings they might work out for you? You may request their services either through our Pittsburgh address, or any of the fourteen Columbia-Southern District Sales Offices.

The Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pennsylvania. Offices in principal cities. In Canada: Standard Chemical Limited.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION A Subsidiary of Pittsburgh Plate Glass Company